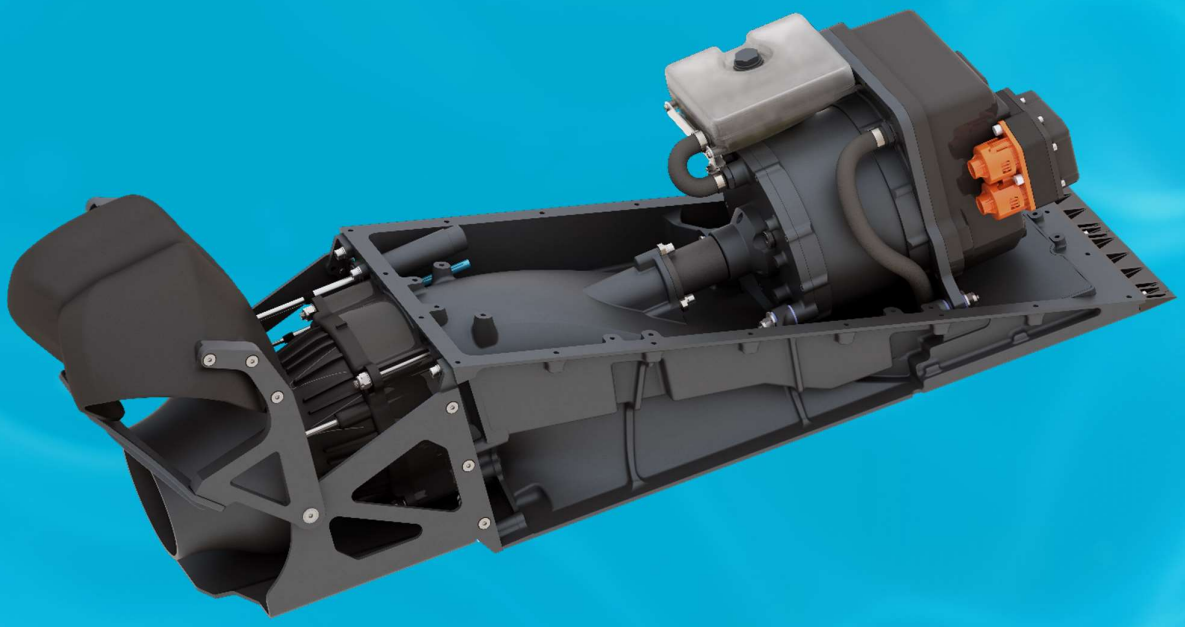
ZEROJET

ELECTRIC JET SYSTEMS



JULY 2024

ZJ20

TECHNICAL SPECIFICATION

ZJ20 TECHNICAL SPECIFICATION

1. Contents

2. Purpose 4
3. Introduction 4
4. Overview 5
4.1. Jet Propulsion 5
4.2. ZJ20 System 5
5. Delivered Items 6
ZJ20 Technical Specification - Electric Propulsion System 8
5.1. Jet Unit 9
5.2. Battery Options 11
5.2.1. ZeroJet 10kWh Battery 11
5.2.2. 5kWh Battery 12
5.3. Control Options 13
5.3.1. Throttle Unit 13
5.3.2. Helm Unit 14
5.3.3. Tiller 15
5.4. Display 16
5.5. Hub 17
5.6. Charger 18
6. Hull Integration of Modules 19
6.1. Jet Unit 19
6.2. 10kWh Battery System 23
6.3. 5kWh Battery System 24
6.4. Side Mounted Throttle 25
6.5. Helm 26
6.6. Tiller 27
6.7. Hub 29
6.8. Display 30
6.9. Isolator Switch 30
6.10. GPS Antenna 31
System Connections 32
6.11. Cable Specifications 32

6.13. Cable Layouts 33
Cable Length Options 35
6.14. System Component Connections 36
6.14.1. Jet Unit 36
6.14.2. 10kWh Battery Box 37
6.14.3. 5kWh Battery Boxes 38
6.14.4. Side Mount Throttle 40
6.14.5. Tiller 41
6.14.6. Hub 41
6.14.7. Display 42
6.14.8. Isolator Switch 42
7. Access Requirements 43
7.1. Jet Unit Dimensions 44
Performance - Sample Builds 47

2. Purpose

The purpose of this document is to capture the technical specifications of the ZJ20 product, relevant for boatbuilders who will be integrating this product into their boat designs.

Disclaimer: All specifications are subject to change, prior to committing to final design it is recommended boatbuilders contact their account manager or sales representative to confirm they are using the most up to date specifications.

3. Introduction

This document provides an overview of the ZeroJet ZJ20 electric jet propulsion system, complete with interfaces and securing options for each component. This document is intended as a guide for boatbuilders to aid integration of the ZJ20 system into their vessels.

The following space envelope files are available as an accompaniment to this document:

1. SE-ZJ-01 V131023 - Jet System Space Envelope
2. SE-ZJ-02 V120324 - Jet Unit
3. SE-ZJ-03 V120324 - 10kWh Battery Pack
4. SE-ZJ-04A V120324 - Left Side Mount Throttle Unit
5. SE-ZJ-04B V120324 - Right Side Mount Throttle Unit
6. SE-ZJ-05 V120324 - MCM Hub
7. SE-ZJ-06 V120324 - 5kWh Master Pack
8. SE-ZJ-07 V120324 - 5kWh Slave Pack
9. SE-ZJ-08 V120324 - Tiller Assy
10. SE-ZJ-09 V120324 - Jet Wedge Mount Geometry
11. SE-ZJ-10 V120324 - Display
12. SE-ZJ-11 V120324 - Isolator Switch
13. SE-ZJ-12 V120324 - Charge Port Extension Cable
14. SE-ZJ-13 V120324 - Jet Unit Basic

The space envelope models referenced in this document are available from ZeroJet and are for information only.

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4. Overview

4.1. Jet Propulsion

Water jet propulsion operates by spinning an impeller to draw water through an intake located at the bottom of the vessel and accelerating it through a stator and then out through a nozzle. The stator straightens the flow of the water and the reaction to the force of the water exiting the nozzle provides the thrust to drive the vessel.

Steering and reverse are achieved by varying the direction of the jet thrust produced. This is achieved utilizing the directional steering nozzle and reverse bucket.

4.2. ZJ20 System

The ZJ20 is a modular water jet propulsion system for boats. The system consists of a bolt-on propulsion unit which integrates the jet pump, electric motor, steering, reverse and hull sealing into a single unit which may be paired with either the ZeroJet helm or tiller options for control, and either the ZeroJet 5kWh or 10kWh battery options.

The ZJ20 propulsion unit has been designed to minimise installation effort with a factory install time for the systems of less than two person-hours:

- The propulsion unit is bolted to wedge geometry defined at the end of this document.
- The battery cases are bolted or tied-in and the cables connected. Any underfloor battery pack is bolted in with a cover, and above-floor battery cases are secured with mounting ties.
- The supplied high-quality cables provide firm connections between jet unit components with easy secure and release. All complex electrical assembly is completed in-house by ZeroJet, so no electrical expertise is required during the installation process. ZeroJet provide installation training and support.
- The ZJ20 can be integrated with common hull materials including aluminium and composites to fit with your preferred style.

Benefits to boatbuilders of the ZJ20 over traditional internal combustion engine powered jets include:

- Turnkey solution - No need for boatbuilders to match engine to jet, the ZJ proprietary pump and motor are pre-coupled and optimised for use together.
- No shaft alignment required.
- No routing of fuel lines.
- Alterations to hull design minimised (See Section 5).
- No need for a gearbox - ICE engines often require a gearbox for:
    - Matching design speed of engine and pump - The ZJ20 motor and pump are designed to run at complimentary speeds.
    - Neutral to stop the impeller when the engine is running - With the ZJ20 when the motor stops, so does the impeller.
    - To offer reverse flow to flush the intake duct when clogged - The ZJ20 motor may be run in reverse.

5. Delivered Items

Core (common to all systems):

- Jet unit – Motor, jet pump, steering nozzle, and reverse bucket.
- System hub - The central control centre of the system.
- Panel mounted display - Information and user interface.
- The isolator switch - Main power isolation switch.
- GPS aerial - For vessel speed data.
- Jet unit seal and fasteners - Bolted seal to hull.

Essential Accessories (Customer Selections):

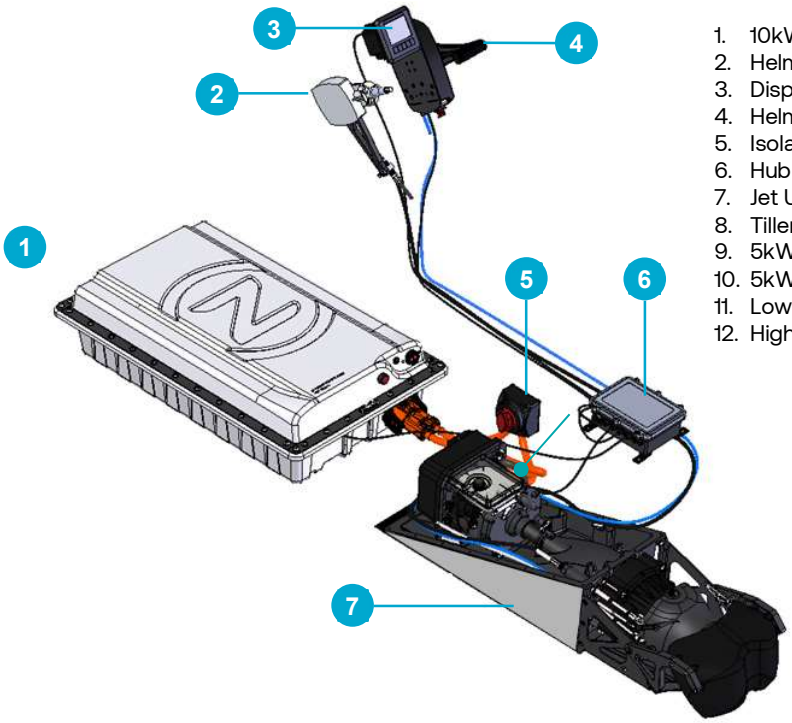
- Battery pack
  - 5kWh battery pack (split pack) **or** 10kWh battery pack (single unit)
- Vessel control:
  - ZJ side mounted throttle unit and helm module **or** ZJ Tiller
- Cable fit kit (for details, see Section 7):
  - Four of the low voltage data cables
  - High-current drive cables
  - Mechanical steering cable
  - Mechanical reverse cable
- ZJ supplied charge solution
- Documentation

Optional accessories:

- Jet-pod cover.
- Charge port extension for mounting remote from battery.

Not supplied

- Steering wheel (not required for tiller systems)



1. 10kWh Battery
2. Helm
3. Display
4. Helm Throttle
5. Isolator Switch
6. Hub
7. Jet Unit
8. Tiller
9. 5kWh Slave Battery
10. 5kWh Master Battery
11. Low Current Data Cable
12. High Current Drive Cable

Figure 1: ZeroJet System Components (10kWh Helm) – Note: Steering wheel not shown for clarity

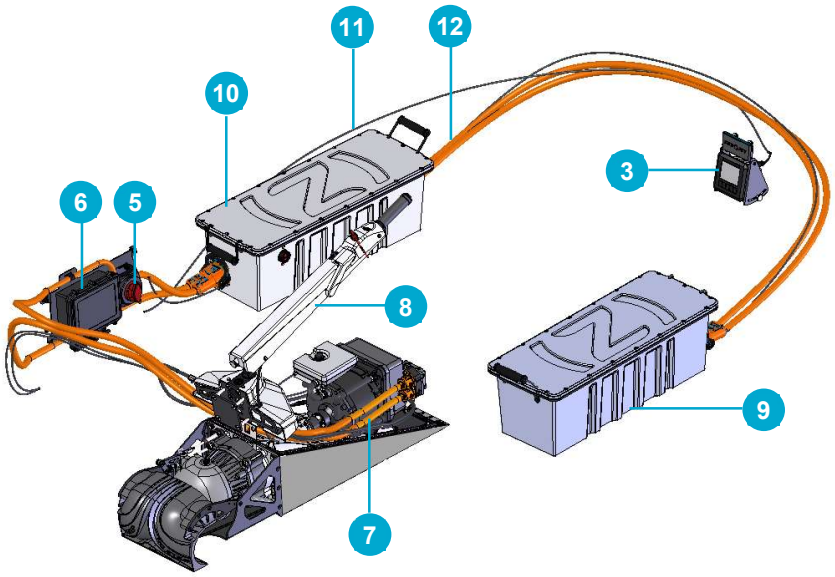


Figure 2: ZeroJet System Components (5kWh Tiller)

ZJ20 Technical Specification - Electric Propulsion System

System Voltage	48V Nominal
Impeller Diameter	150mm
Power	18kW Continuous[1], 15kW-rated
Motor Type	Closed loop-liquid cooled, Brushless DC, Integrated controller
Battery	5kWh/10kWh options $LiFePO_4$
Steering	Tiller/Helm options
Thrust	See Thrust Curve section
Max Speed (See section 8)	20knots
Range	12 nautical miles @18knots
Max Operating Water Temperature	35°C
Control Software	ZeroJet proprietary, updates through USB
Waterproof	IP67
Compliance	CE rated
System installation time	Approximately 2 hours[2]

Mass (Subsystems)	
Jet Unit	44kg
10kWh Battery Pack	98kg
5kWh Battery Pack	55kg
Helm Throttle	2.1kg
Tiller	4.3kg

Additional Features

- Integrated motor stop safety tether
- Pump intake grate - removable for clearing
- Shaft seal, shaft, coupling and bearing arrangement designed for reliability and ease of maintenance
- GPS
- Jet clear reverse function
- Screen functions - SoC, battery voltage, current draw, charging status, system status, temperature, throttle/RPM and alarms
- Auxiliary port - 48V, 5A. Can be used for third party DC-DC convertors to support 12V accessories.

[1] Based on the battery draw from the 10kWh battery option, the 5kWh battery option limits the draw to 14kW.
[2] Into ZJ20 compatible hull

5.1. Jet Unit

Description
The main propulsion element of the system, the jet unit incorporates:

- Jet pump
- Propulsion electric motor and controller
- Steering nozzle
- Reverse bucket
- Motor cooling system (heat exchanger and pump)
- Hull integration flange

Motor	18kW continuous, liquid-cooled. 15kW rated
Thrust	See Thrust Curve (Figure 4)
Impeller	150 dia.
Steering	Nozzle Arrangement - Mechanical Cable Operation
Mounting	Bolted Hull Interface
Hull Seal Type	Aluminium/Polymer Bolted Interface
Shaft Seal	Carbon Ceramic Mechanical
Reverse	Bucket – Mechanical Cable Operation

Cooling System

Type	Closed loop liquid/Integrated keel cooler
Maximum operating temperature	35°C Water Temperature
Circulation Method	24V pump
Coolant	Isovoltine (or equivalent)

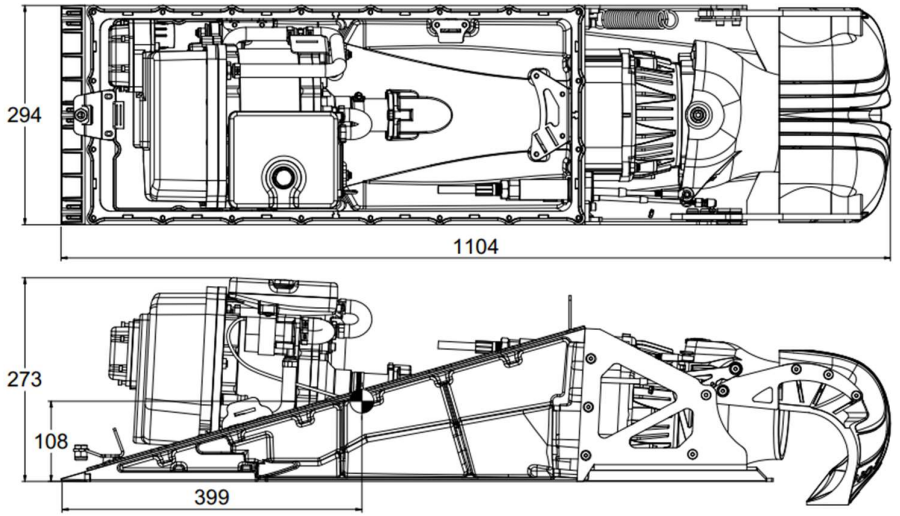


Figure 3: Propulsion Unit Principal Dimensions

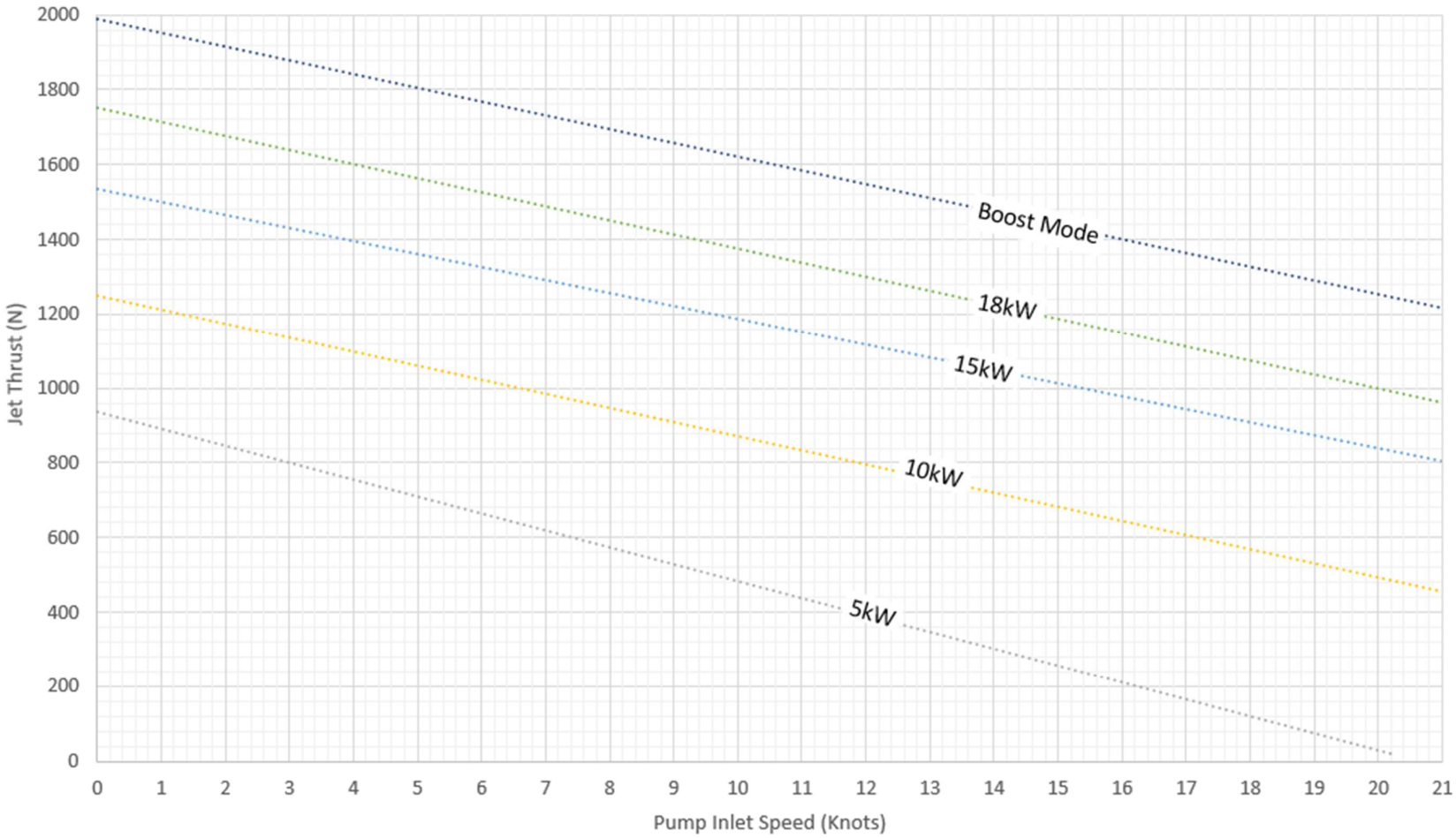


Figure 4: System Thrust Curve (note, Boost Mode is a future development)

5.2. Battery Options

5.2.1. ZeroJet 10kWh Battery

Description

The 10kWh battery box interfaces with the vessel at a mating face around the outer edge of the box. This mating face has been designed such that the battery box may be semi-recessed into the deck or mounted on structure fully below deck.

Max power draw	18kW
Capacity	210Ah
Nominal Voltage	48V
Full throttle current draw	360A
Auxiliary Output	48V nominal, 5A, user replaceable fuse.[3]
Weight	98kg
Waterproof Rating	IP67
Physical	Single Pack
Mounting arrangement	Bolt Flange

Principle Dimensions

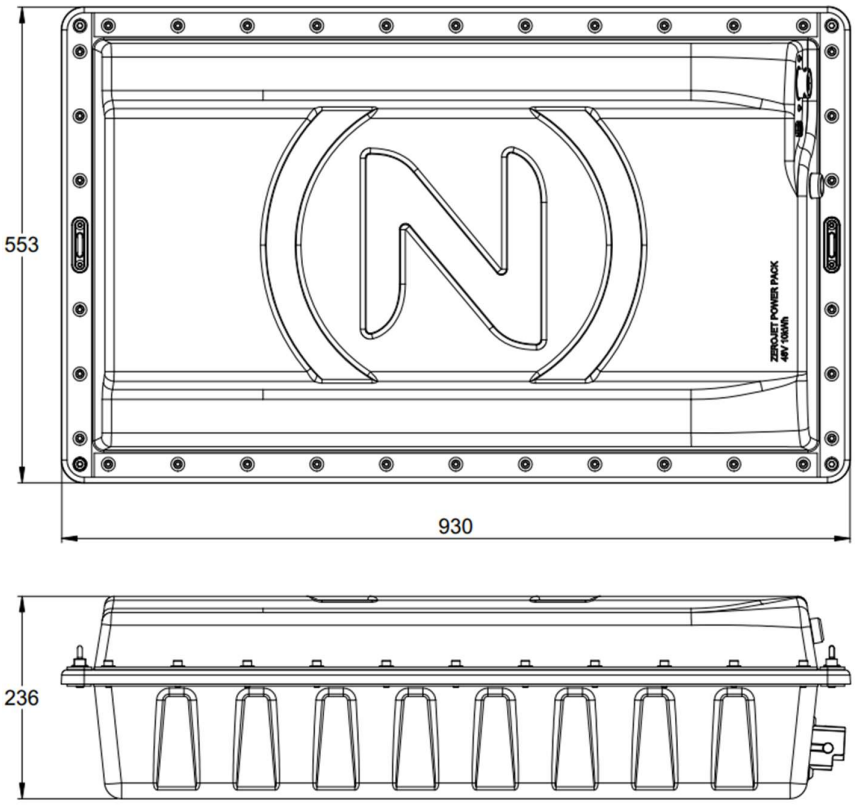


Figure 5: 10kWh Battery Principal Dimensions

[3] ZeroJet app note available upon request

5.2.2. 5kWh Battery

The 5kWh battery option is packaged between two enclosures to allow the batteries to be easily removed by the user where required. Drive cables and data cables from the slave pack (lower) are plugged into the master pack (upper), which in turn plugs into the propulsion unit.

Capacity	105Ah
Nominal Voltage	48V
Full throttle current draw	280A
Auxiliary Output	48V nominal, 5A, user replaceable fuse.[4]
Weight	55kg (pair)
Waterproof Rating	IP67
Physical	Split Twin Packs
Mounting arrangement	Deck Straps

Principal Dimensions

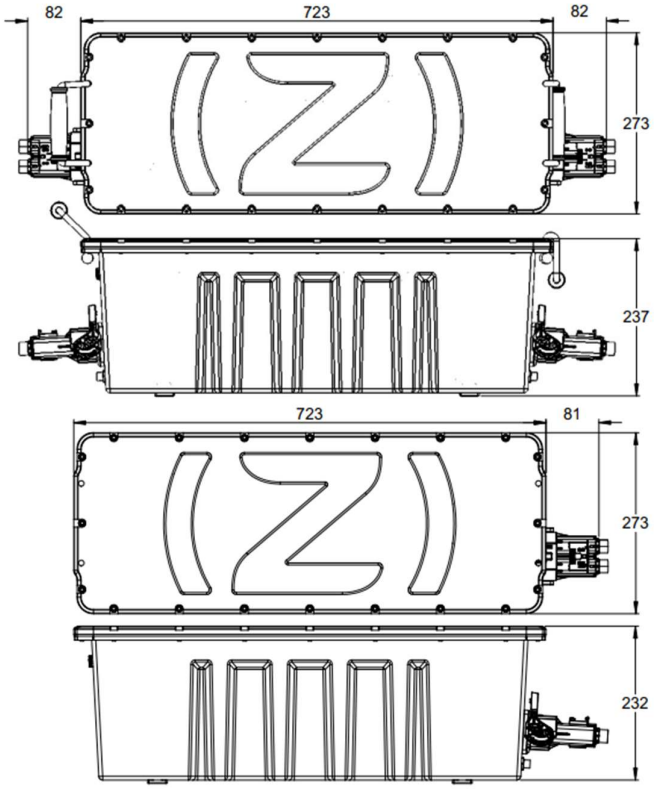


Figure 6: 5kWh Battery Principal Dimensions (Master at top)

[4] ZeroJet app note available upon request

5.3. Control Options

5.3.1. Throttle Unit

Description

The throttle unit is a side mounted configuration, requiring a flat vertical mounting surface at the helm station to mate with and can be supplied in either **left or right mount options**. The throttle unit connects to the ZeroJet system via a data cable to the hub and a mechanical cable linkage to the jet unit for activating the reverse bucket.

This throttle option is designed for use in conjunction with a wheel-based console helm unit supplying steering function (see below).

Steering Input	Helm Mount Wheel
Steering & Reverse	Mechanical Cables[5]
Throttle Input	Side Mount Lever/Neutral Lock
Throttle Actuation	ZJ Proprietary, Electrical

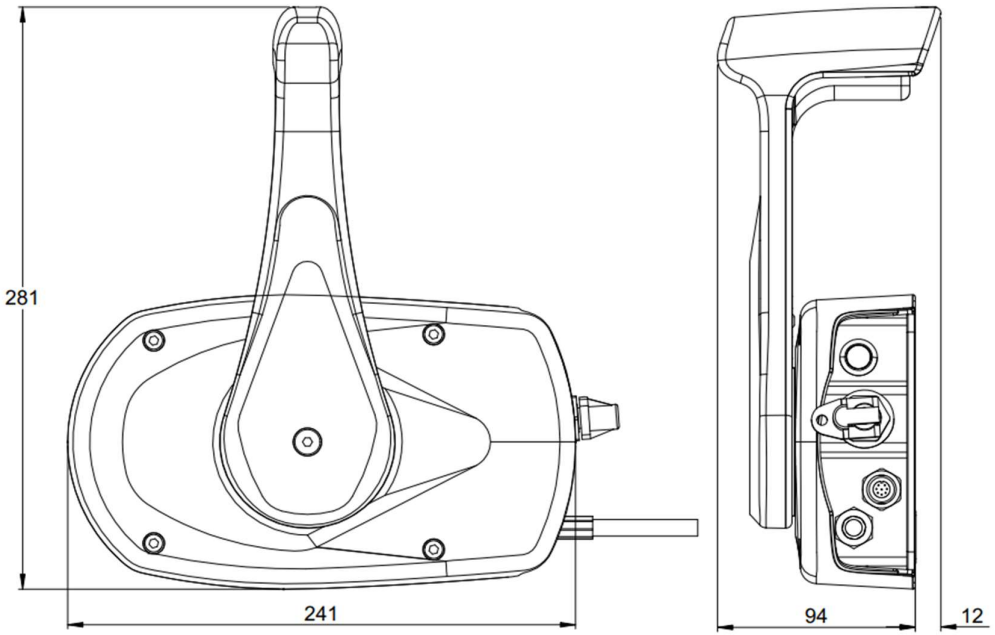


Figure 7: Side Mount Throttle Principal Dimensions (right-side mount shown)

[5] Various cable lengths available, see Section 7.

5.3.2. Helm Unit

Description

This steering option is designed for use in conjunction with a ZeroJet side mounted throttle unit.

Steering Input	Wheel
Steering Throw	270°
Actuation	Mechanical Cable to Jet Unit
Connection	Threaded

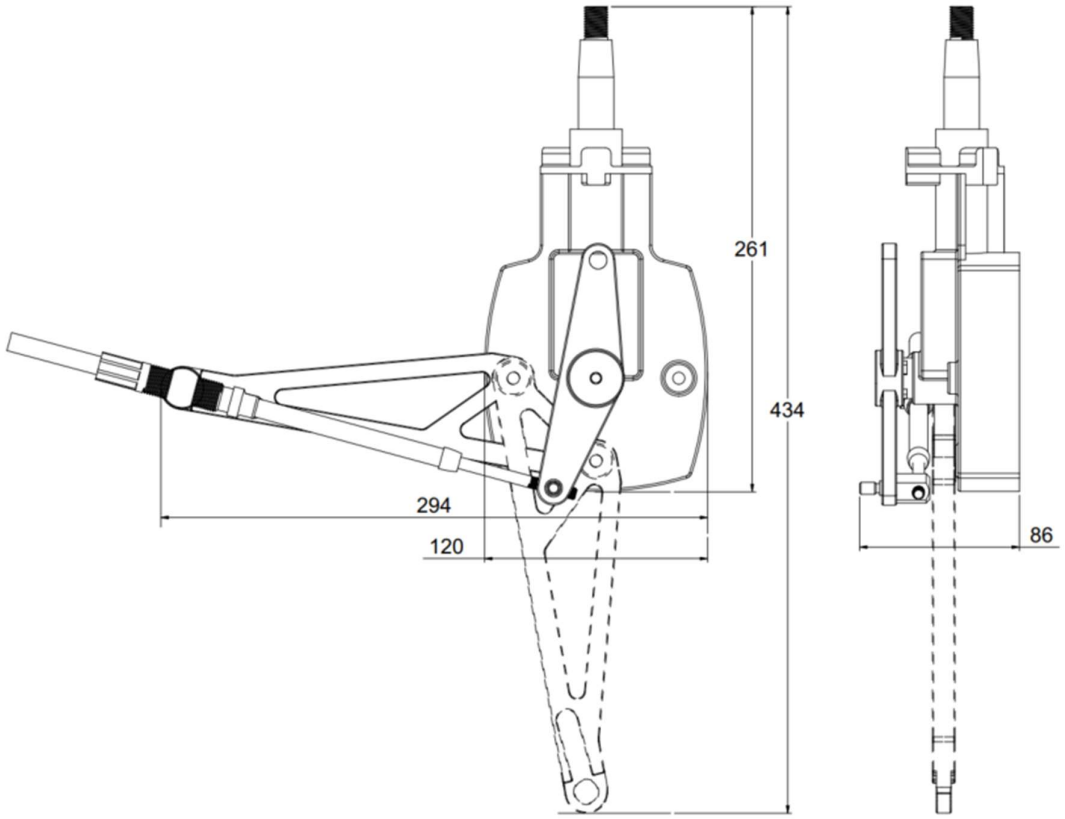


Figure 8: Helm Principal Dimensions (Alternative Arrangement Dashed). Reversible

5.3.3. Tiller

Description

The tiller is geared to give a 50° steering arc. The tiller has controls for the throttle, on/off, emergency tether and reverse bucket. It is connected to the system hub via a data cable and to the jet unit with two mechanical cables for steering and reverse.

Steering Input	Tiller 50° arc
Steering Actuation	Mechanical Cable
Throttle Input	Twist Grip with Spring Return
Throttle Actuation	Electrical
Reverse	Tiller Handle - Separate Lever Mechanical Cable

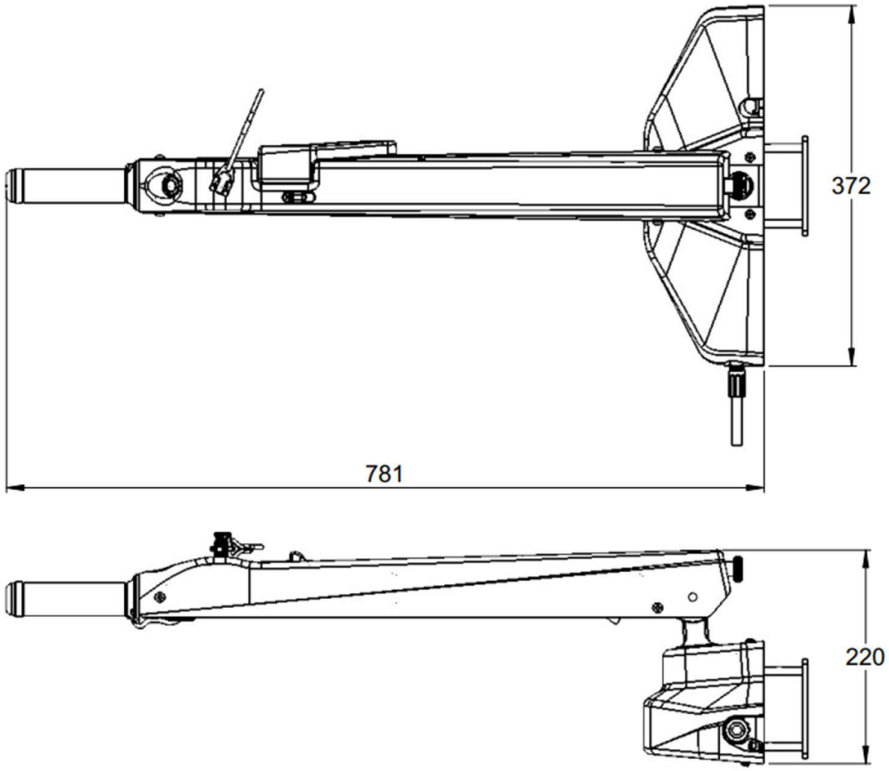


Figure 9: Tiller Principal Dimensions

5.4. Display

Description

The outdoor readable LCD is the main user interface for the ZJ20 system and displays status and other information in a clearly understood format.

Display	ZJ supplied screen
Display Size	3.5”
Brightness	750 cd/m^2 sunlight readable
Resolution	320 x 240
IP Rating	IP67
Operating Temperature	-20°C to +70°C
Controls	Physical buttons (no touchscreen)
Audio	Integrated sounder
Compliance	IEC60945
Mounting	Console or Remote
Interfaces	CANbus USB for software upgrades

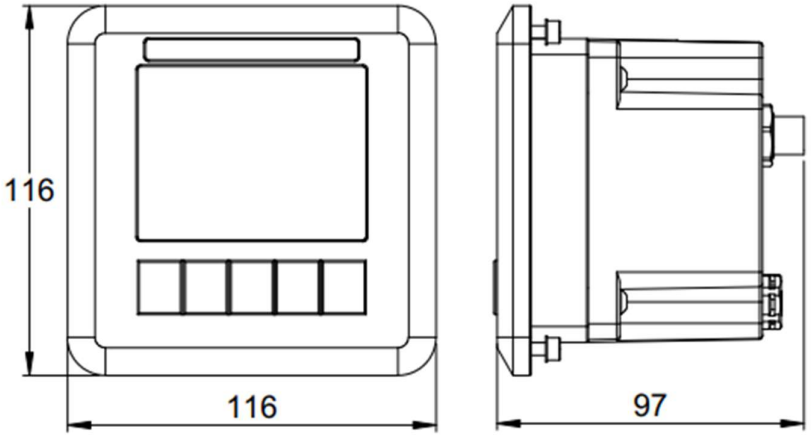


Figure 10: Display Principal Dimensions

5.5. Hub

Description

The central control module for the system. Low voltage cables run from the hub to the throttle, display, battery, jet unit and GPS antenna. Routing of these cables should be considered when determining a suitable location for the hub. Service access should also be considered. The USB-A port located on the left of the hub connectors surface is used for software updates.

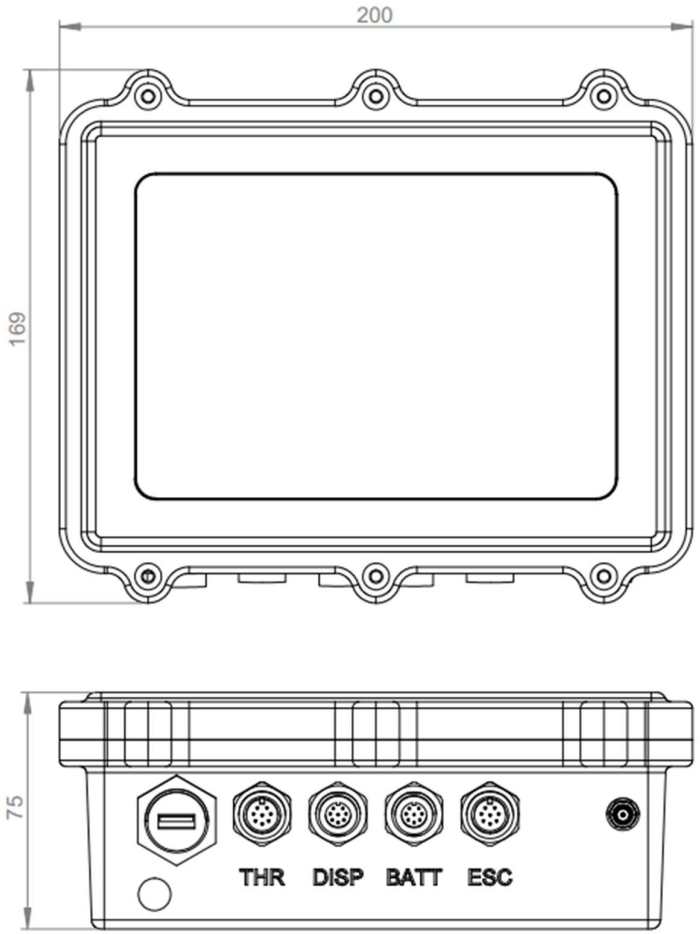


Figure 11: Hub Principal Dimensions

5.6. Charger

Description

Please note that this system must be utilised exclusively with the charger provided by ZeroJet. The use of any other charger may compromise the safety, functionality, and warranty of the system.

Charger	
Input Voltage	90 to 265V_{AC} (automatic)
Input Frequency	47 to 65Hz (automatic)
	Suitable for operating from AC generators
Output	Voltage: 48V_{DC} nominal, 40A_{max} (32A_{max} at 120V_{AC})
Dimensions	H 360 x W 270 x D 130 mm
Weight:	6.8kg
Protection factor	IP23 (dry location installation)
Cooling	Integrated electric fan
Temperature	Full rated charge current from 0°C to +40°C, and derated thereafter.
Fast Charge	Option available – contact ZeroJet

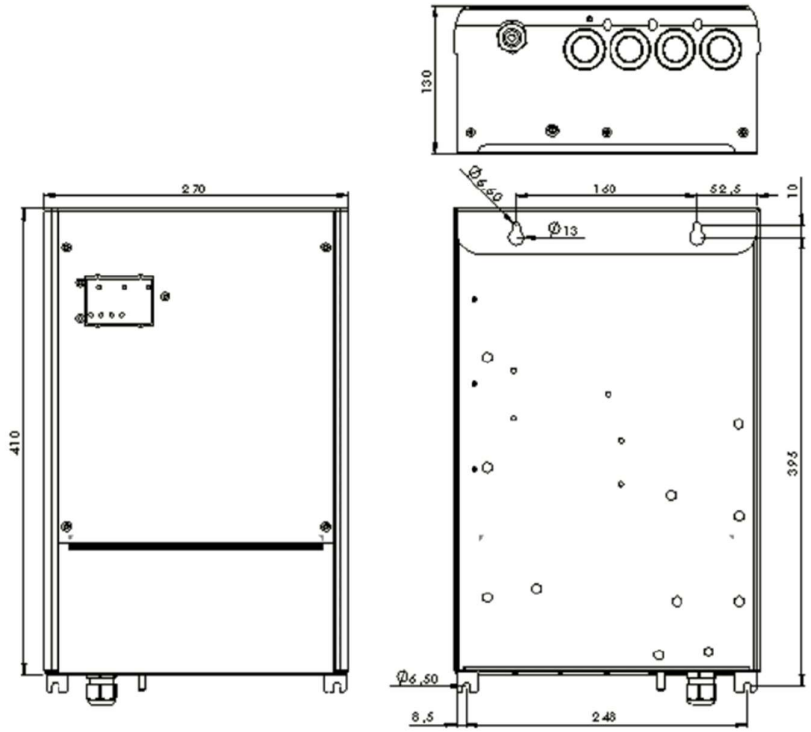


Figure 12: Charger Principal Dimensions

6. Hull Integration of Modules

Vessel hull geometry is usually complex, and this has been considered in the design of the ZJ20 system specifically to simplify the integration process. These requirements have been consolidated to a small number of straightforward interfacing surfaces to ensure vessel compatibility. These requirements are listed below:

- A flat surface 16.1° to the keel line on which to mount the jet pod
- A location for the batteries
- A mount point for either the tiller or the helm/side mount throttle assemblies
- A location to mount the system hub
- A visible location to mount the display
- An easily accessible location to mount the isolator switch
- A location to mount the GPS antenna (already integrated into tiller)
- Suitable cable routes and fixings between components

With the motor and pump assembled into a single unit prior to delivery, alignment of pump and power unit during installation is no longer required.

To aid integration, space envelopes for each of the major elements of the ZeroJet system accompany this document.

6.1. Jet Unit

To maintain a simple interface, the jet unit connects to a single, flat sealing face positioned at the hull's stern, at an angle of 16.1° to the vessel's keel line. This level area is drilled and cut to establish a secure connection with through studs on the jet unit, ensuring a watertight seal against the outer hull surface. The maximum recommended hull thickness around the bottom edge of the wedge is 20mm.

This geometry may be created in a number of ways, though the following options have been demonstrated:

- Folded from a single sheet of aluminium and welded into the hull[6]
- Incorporated into the vessel mould either as a plant or permanent fixture
- Created from GRP and retrofitted into a current hull[7]

A sample jet wedge for an insert arrangement is given at the end of this document. This arrangement is given for illustrative purposes only, it is the responsibility of the boat builder to ensure that the hull arrangement is of a suitable design and strength for their use cases.

[6] 4mm has been demonstrated.
[7] Sample geometry included with space envelopes.

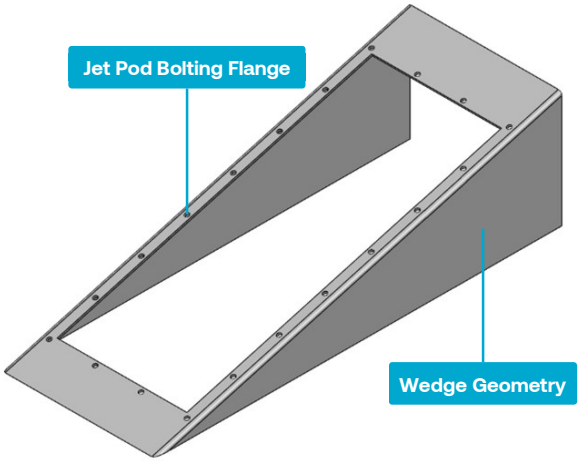
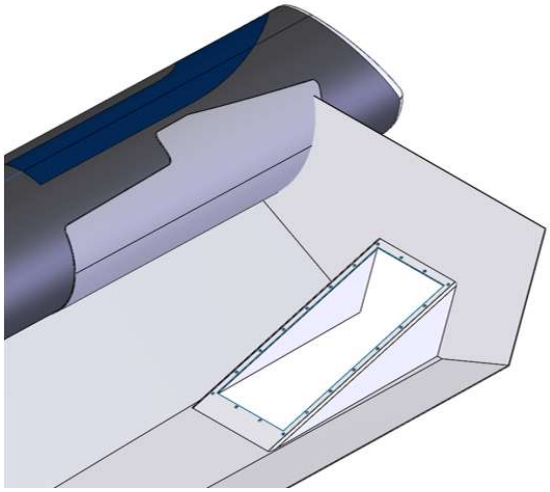


Figure 13: Interface Geometry to be Incorporated into Hull



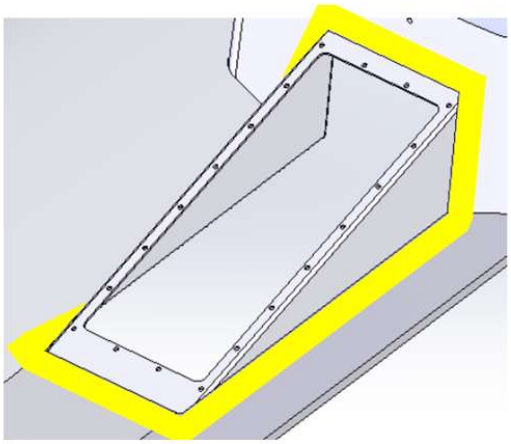


Figure 14: Integrate Wedge Geometry into the Hull. Figure 7: Leave 100mm free hull surface on all sides of wedge area

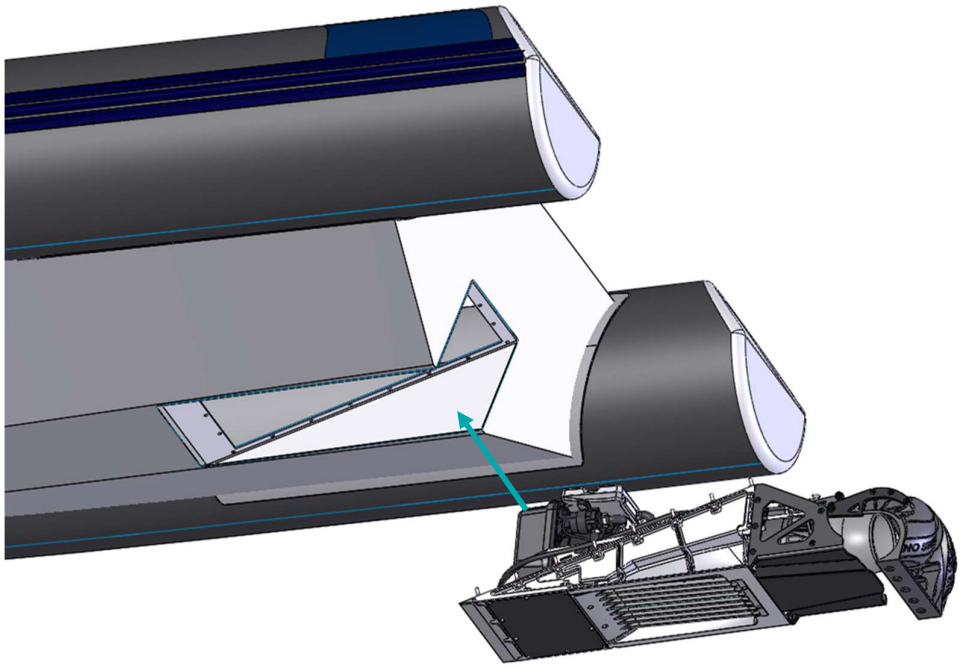


Figure 15: Position Jet Unit from Below (simplified jet shown)

The propulsion unit is raised into the hull from below, aligning the fastening studs through the drilled holes.

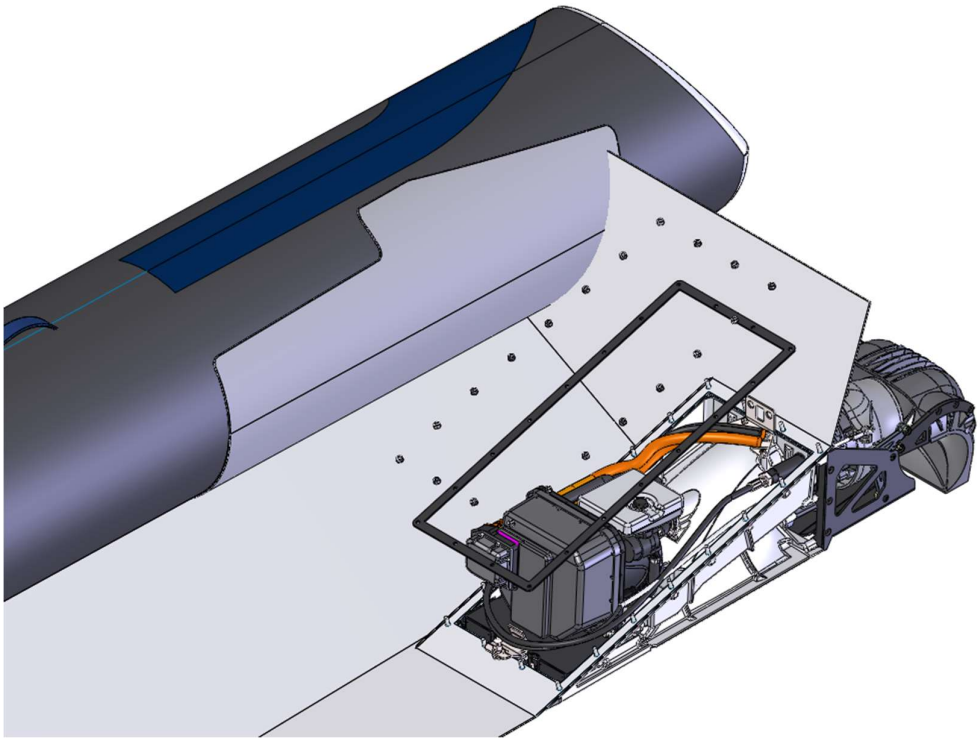


Figure 16: Fasten Jet Unit to Hull

The jet unit is secured into the wedge with stainless steel locking nuts and, where appropriate, washer pate compressing the seal against the hull surface.

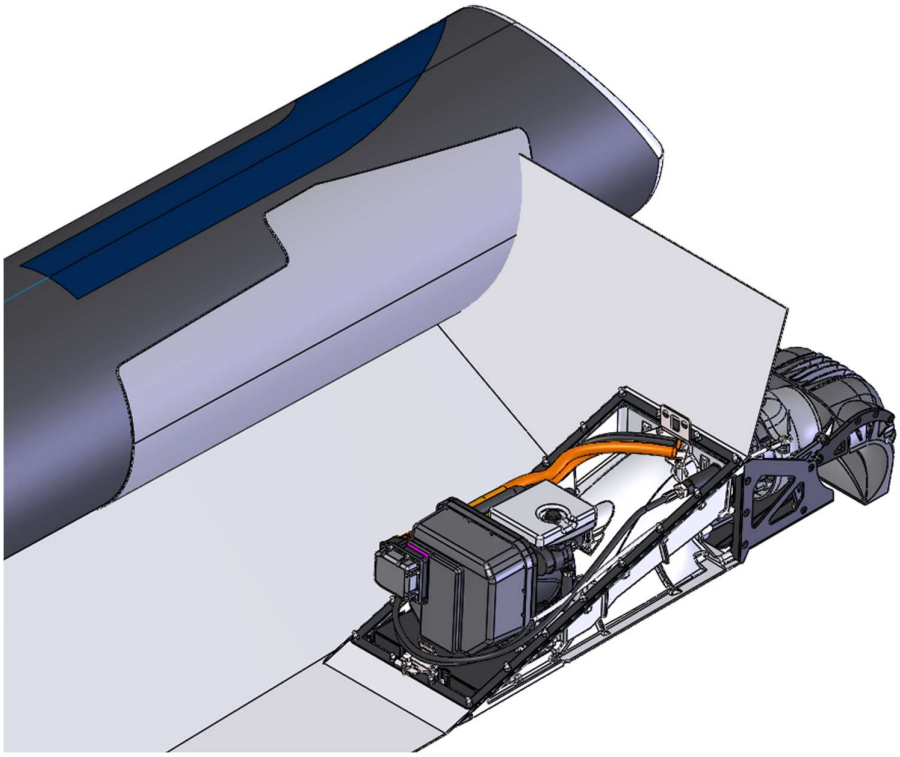


Figure 17: Jet Unit in Position in Hull

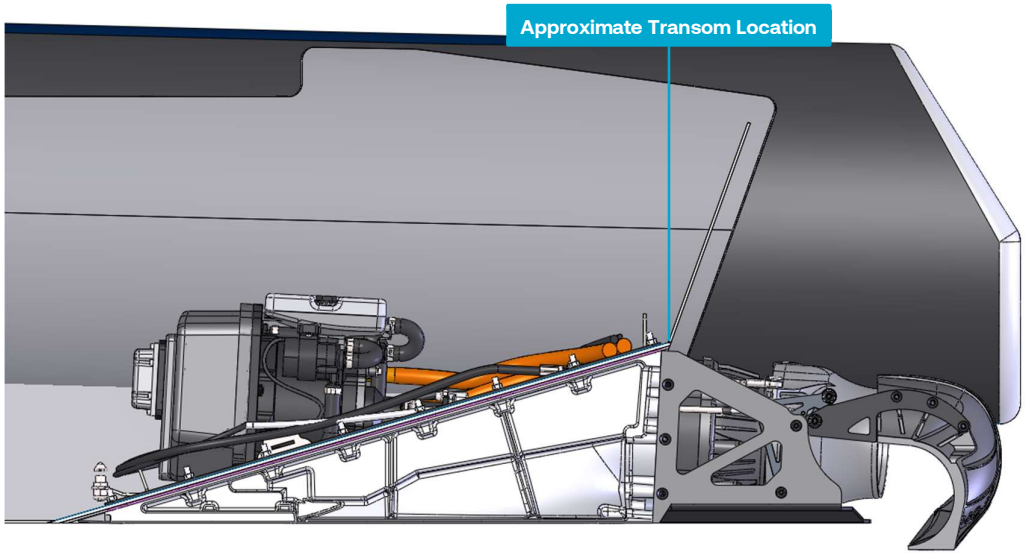


Figure 18: Approximate Transom Location

6.2. 10kWh Battery System

The 10kWh battery box interfaces with the vessel at a mating face around the outer edge of the enclosure. This mating face has been designed such that the battery box may be mounted on structure fully below deck. Four M8 through holes are supplied in this flange to secure the battery box. Alternatively, the box may be positioned on a flat surface on or below the deck and strapped down to secure. Two hoist points are provided to allow the battery system to be lifted/lowered using appropriate machinery. Solid models, such as a STEP file can be provided to give accurate detail on user interfacing and cable exit points.

Optional extension wiring can be provided to allow battery on/off, auxiliary output and charging to be fitted in more convenient locations for user access. Contact ZeroJet for more information.

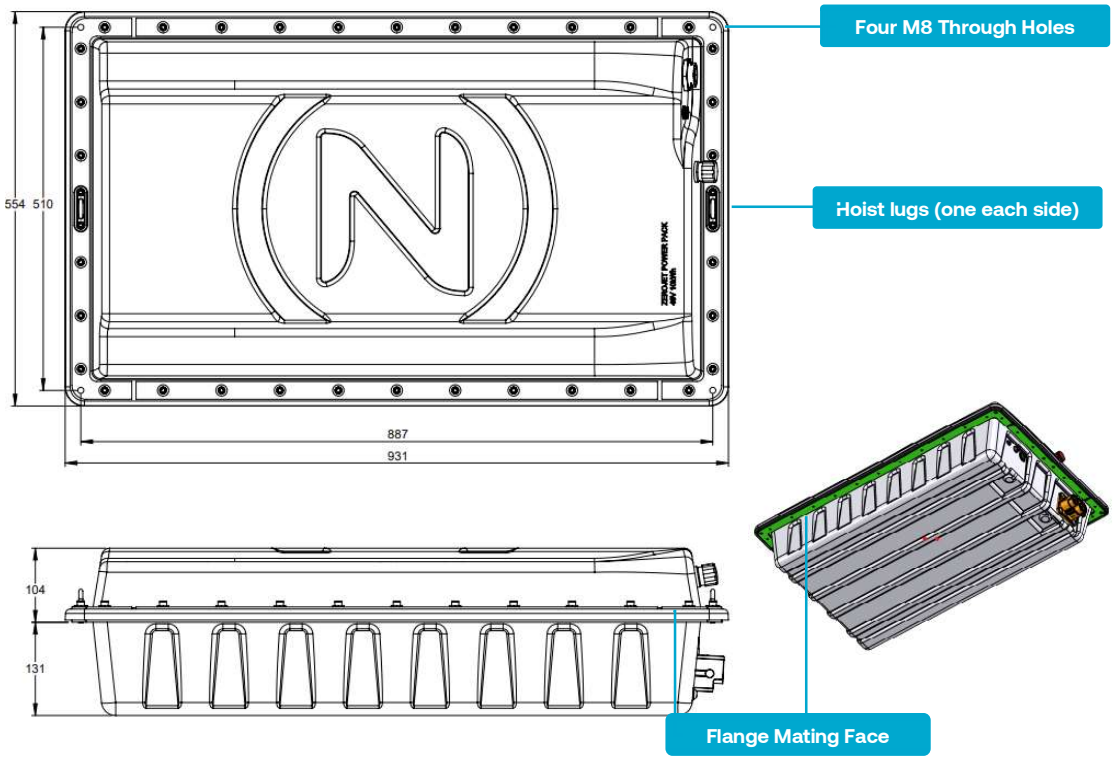


Figure 19: 10kWh Battery Pack Bolt Down Points and Mounting Flange

6.3. 5kWh Battery System

The 5kWh battery system is split across two enclosures for ease of lifting. These boxes are designed to sit on the deck on the integrated feet and must be secured in location. This may be achieved using ratchet straps or other forms of mechanical retention.

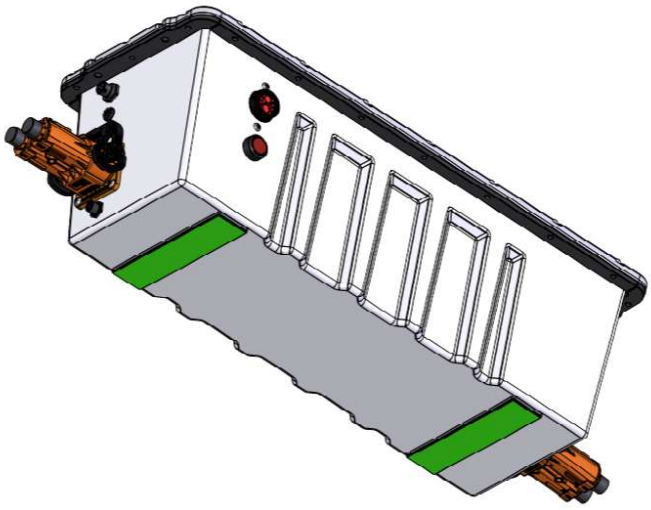


Figure 20: 5kWh Base Feet

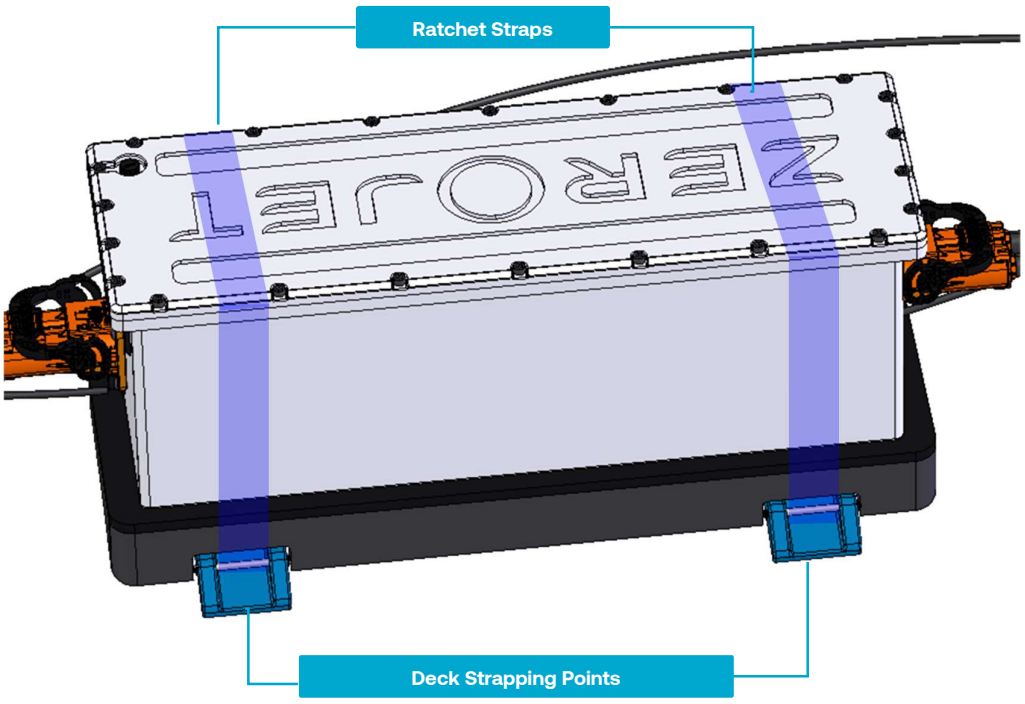


Figure 21: 5kWh Battery Sample Strapping Arrangement

6.4. Side Mounted Throttle

The side mounted throttle is designed primarily for console use; however, it may be mounted to any flat surface which may be bolted through. The throttle provides four M6 tapped holes in the back plate for securing to the vessel mount.

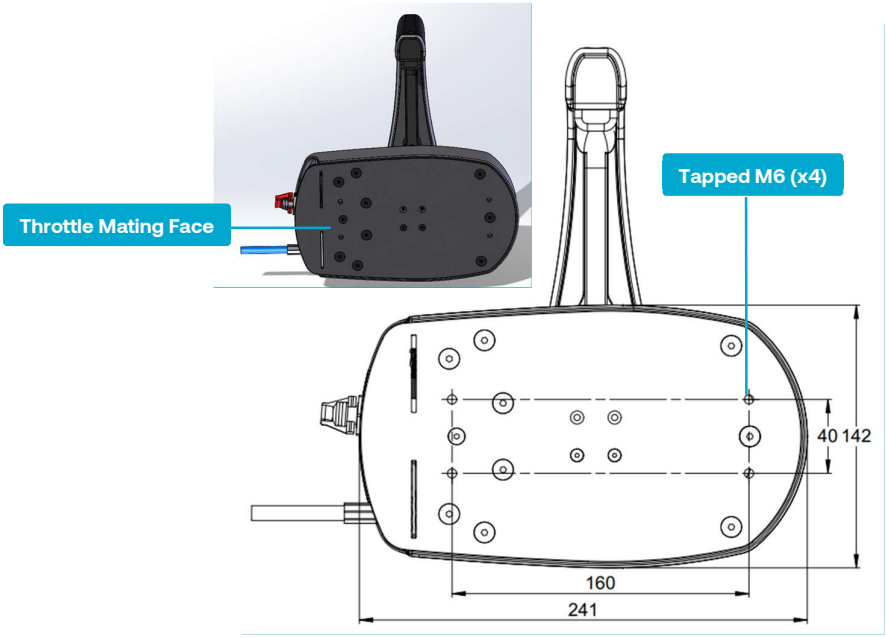


Figure 22: Side Mounted Throttle Mounting Points

6.5. Helm

The helm is aft mounted in the console with three ¼“UNC through bolts (supplied) to secure it. The steering cable threads onto the support bracket, which may be arranged in one of four positions (see Section 5.3.2).

The steering wheel (boatbuilder supplied), mounts to a standard ¾” tapered shaft.

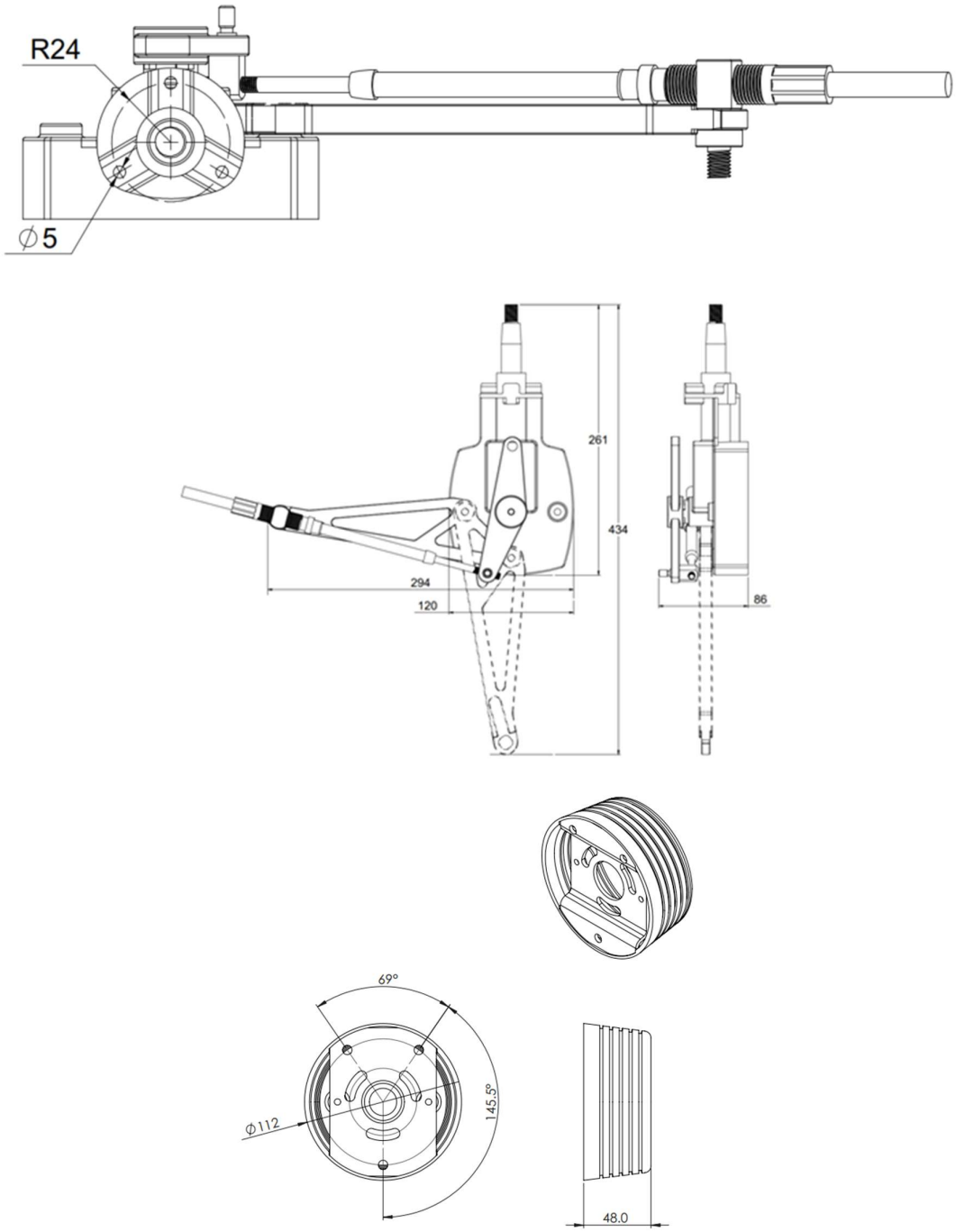


Figure 23: Helm Mounting Points

6.6. Tiller

The tiller is provisionally designed with the intention of mounting to the transom, although the cable design allows for mounting remotely from the propulsion unit to any transverse flat surface in the vessel.

The tiller is through-bolted to the transom by four M6 countersunk fasteners and secured with nyloc nuts. A clamping plate is supplied to distribute the load on the transom outside.

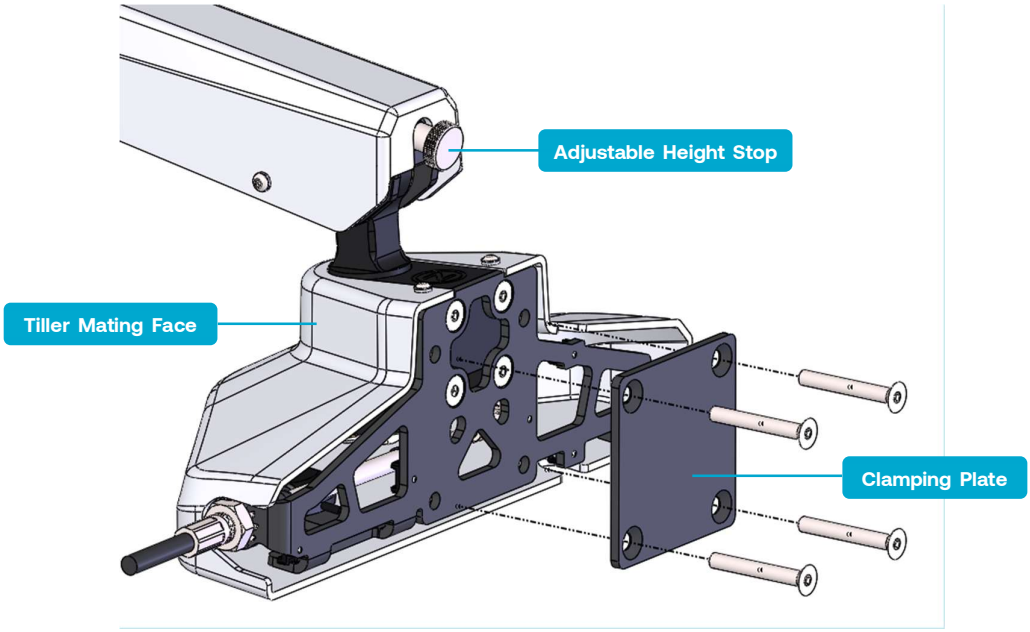


Figure 24: Tiller Mounting Arrangement

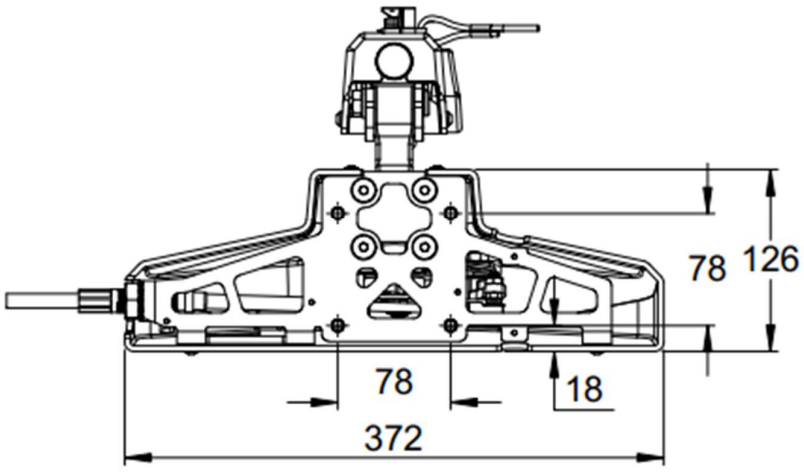


Figure 25: Tiller Mounting Bolt Pattern

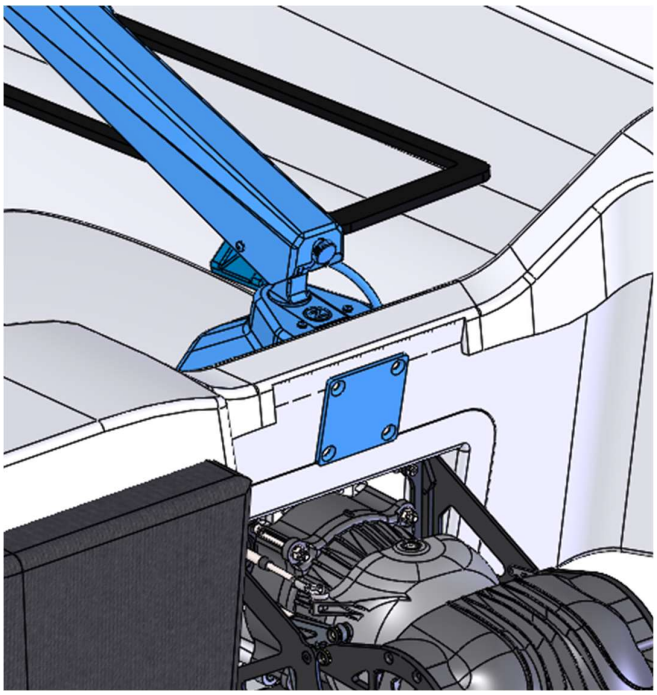


Figure 26: Example - Tiller Mounted on Transom

The tiller is geared to give a 50° steering arc and pivots vertically as well as horizontally on its mount allowing for a variation in transom angle and use height. The end-stop lowest position may be adjusted via a rotary input to suit user requirements.

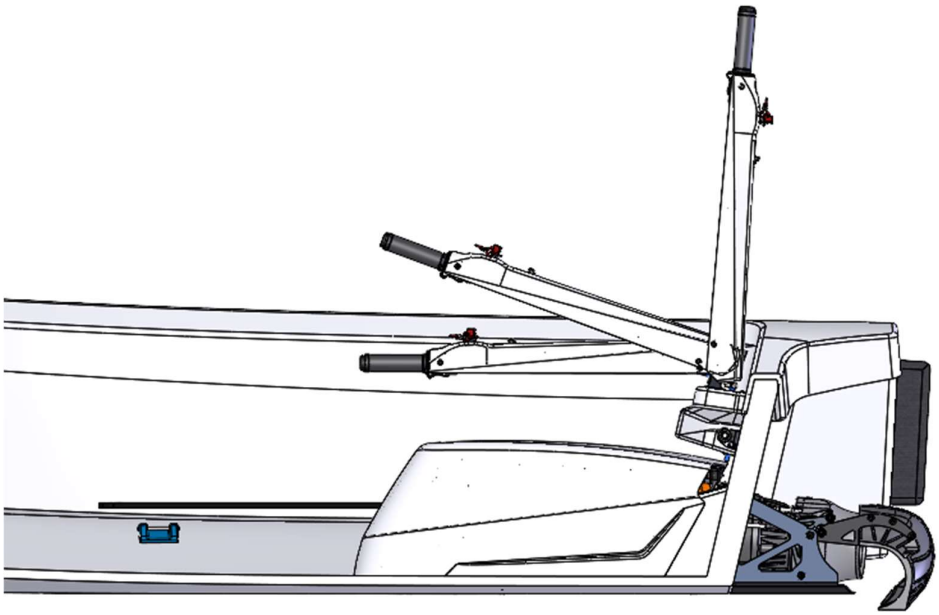


Figure 27: Adjustable Tiller Angle

6.7. Hub

The hub is the main control unit for the ZJ20 system. Four M5 tapped holes are provided in the aft side of the hub for mounting. Additionally, four optional mounting feet are provided to be used as necessary. Updates to the system software can be made using the USB port.

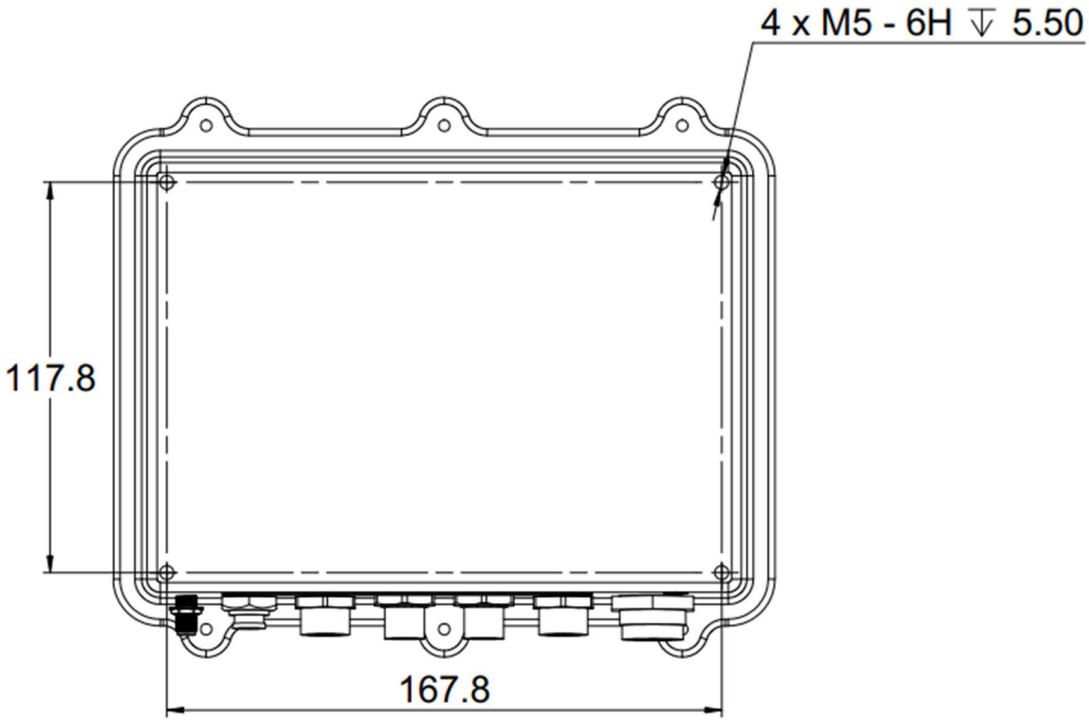


Figure 28: Hub Mounting Bolt Pattern

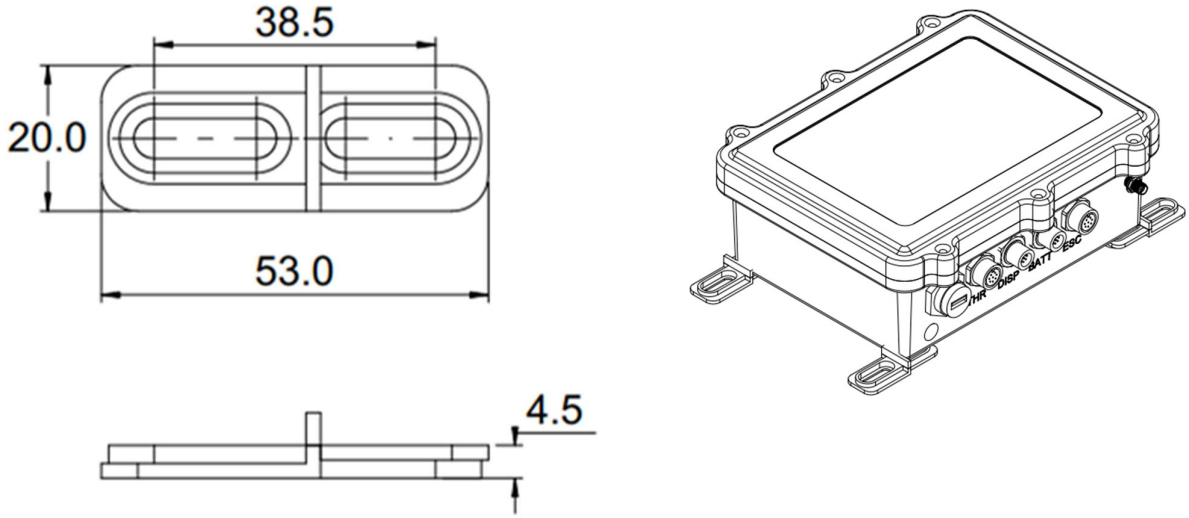


Figure 29: Hub Optional Mounting Feet (four supplied)

6.8. Display

The display recesses into a panel mount and is secured with four M4 screws. A 96 x 96mm hole is to be cut into the console to recess the display.

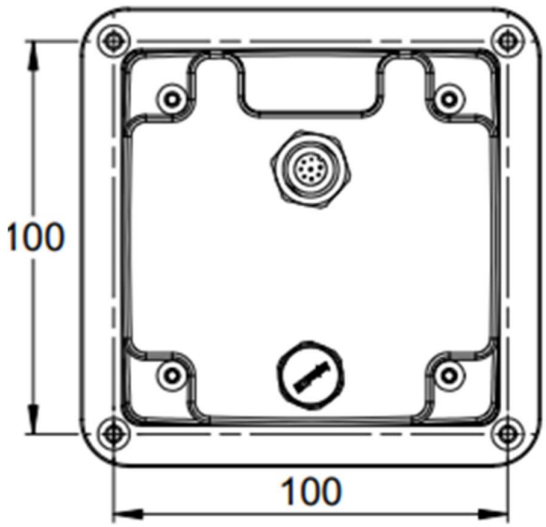
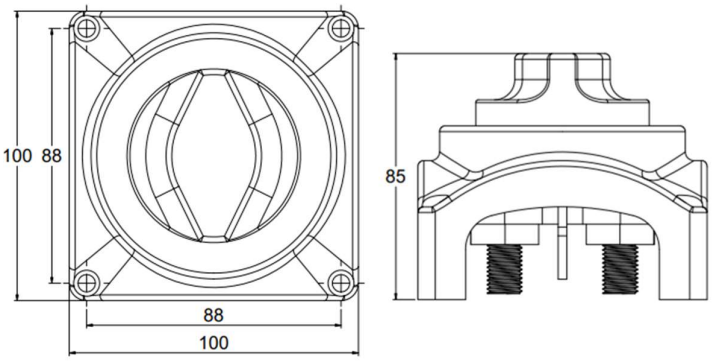


Figure 30: Display Mounting Points

6.9. Isolator Switch

Four M6 screws secure the mounting hub. Provision to rear mount or face mount is supplied. It is imperative that high-current cables are well secured on entry and exit to the isolator switch to prevent any undue stress on the switch terminals, such as mechanical shock or vibration that could be experienced by small tenders.

Note that the isolator switch has provision for a padlock to be fitted should this be required by the end-user.



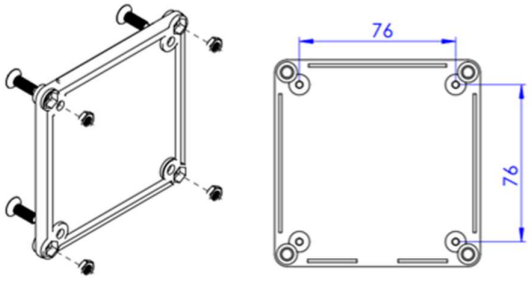


Figure 31: Isolator Switch Mounting Points

6.10. GPS Antenna

The ZeroJet system used GPS to calculate vessel speed. For best results the supplied GPS antenna will be located such that it has a clear view of the sky. In the tiller configuration it may be mounted within the tiller mechanism cover, and it has been demonstrated to work mounted inside the vessel console. These configurations should be tested before finalising. The antenna is secured with a self-adhesive backing and connected to the hub with a low current cable.

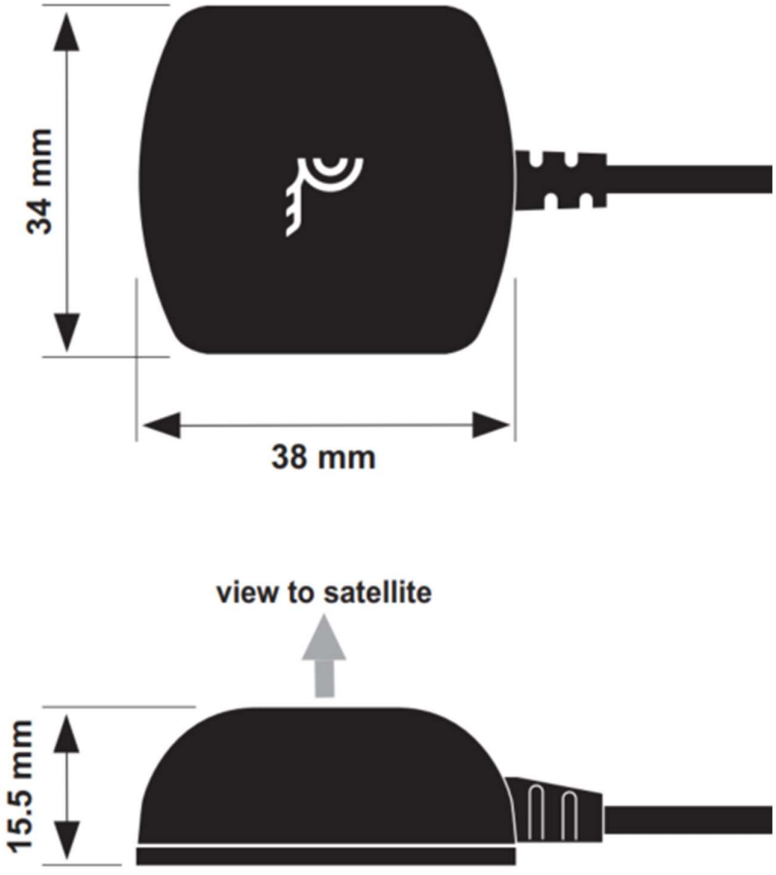


Figure 32: GPS Antenna

System Connections

Each of the major components of the system is connected to the hub via a low current multicore data cable. High current cables connect the battery pack to the propulsion unit via the isolator switch. All component connection cables are supplied with the ZJ20 system.

6.11. Cable Specifications

Cable	Type 1 Cable: 10kWh HC1-3 in Figure 33	Type 2 Cable: 5kWh HC1-4 in Figure 34	Data Cable D1-4 in Figure 33 D1-5 in Figure 34	Steering Cable	Reverse Cable
Type	95mm^2	70mm^2	Over moulded multicore	Stainless steel mechanical	Stainless steel mechanical
Items Connected	Battery Pack (10kWh) Propulsion Unit Iso Switch	Battery Packs (5kWh) Propulsion Unit Iso Switch	4 x, Hub to: Propulsion Unit	Propulsion Unit Helm or Tiller	Propulsion Unit Throttle or Tiller
Minimum Bend Radius	55mm	46mm	N/A	125mm	100mm
End Connections	IP67 Latching Plug with interlock	IP67 Latching Plug with interlock	IP68 Threaded Plug	Threaded	Threaded
Length Options	Figures 33 and 34 show interconnects between the ZeroJet system subsystems. See Appendix B for options.			Standard length is 2.45m for tiller steer and 3.80m for helm steer. Available in 0.5m increments. **Contact ZeroJet for alternative requirements.**	Standard length is 2.18m for tiller steer and 2.60m for helm steer. Available in 0.5m increments. **Contact ZeroJet for alternative requirements.**
Notes	Sealable plug caps provided for when disconnected				

6.13. Cable Layouts

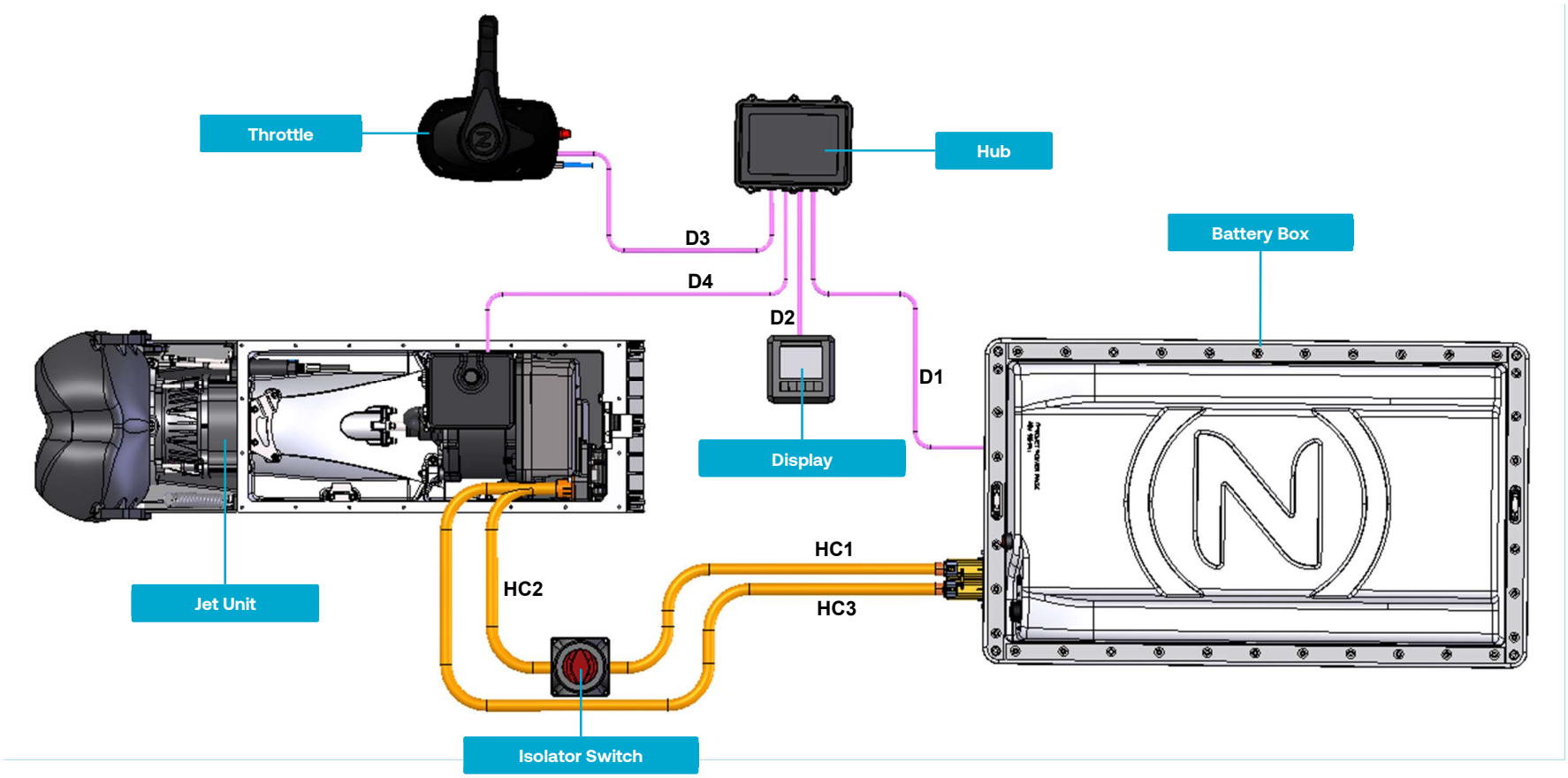


Figure 33: 10kWh Electrical Cable Layout

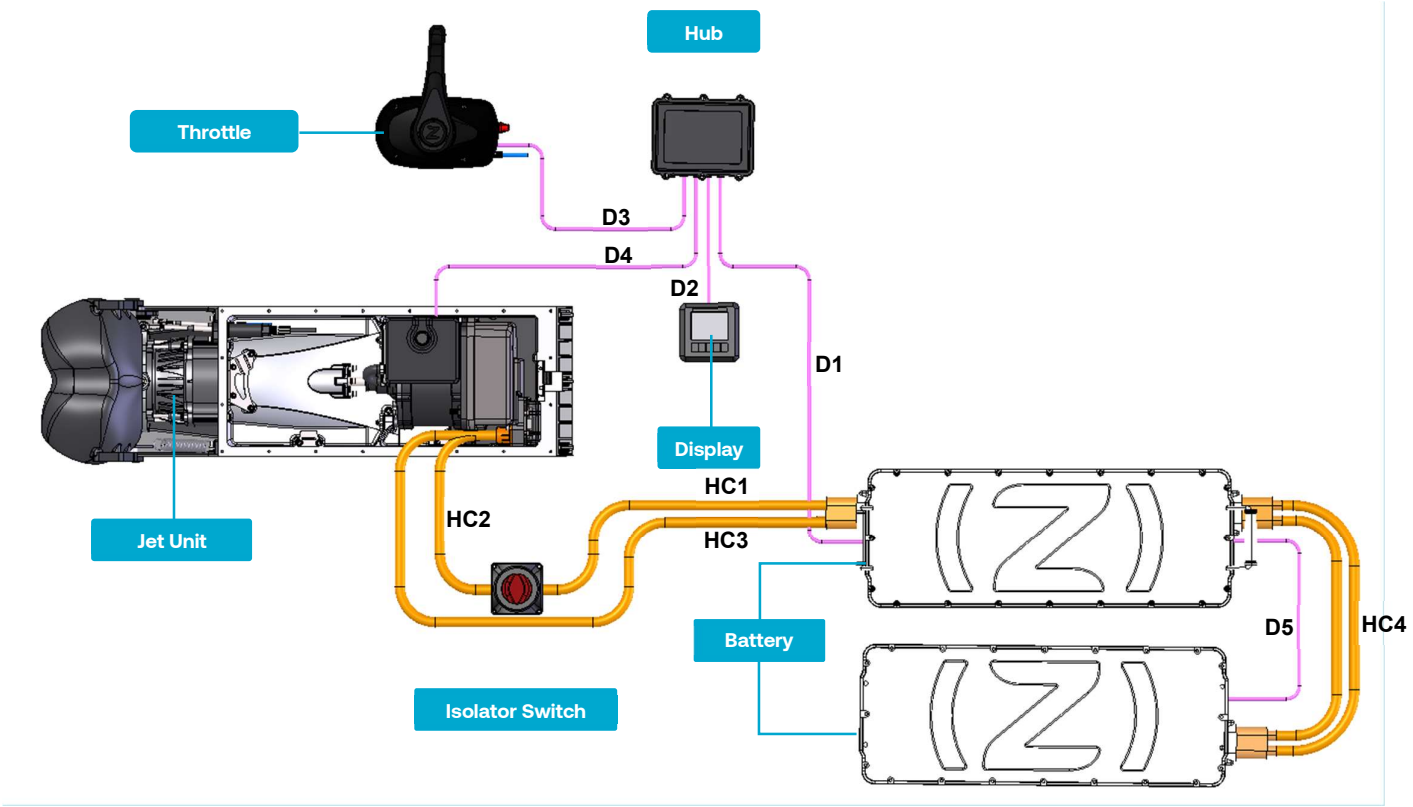


Figure 34: 5kWh Electrical Cable Layout

Cable Length Options

The table below outlines the standard cable lengths for the ZJ20. These can all be made to custom lengths. Contact ZeroJet for more information.

Cable Type	Description	ID (figures 33 & 34)	Standard Length (m)
Data	Hub to Display	**D1**	1.5
	Hub to Battery	**D2**	1.0
	Hub to Throttle	**D3**	1.5
	Hub to Motor	**D4**	1.0
	Battery: Master to Slave	**D5**	3.4
High Current	Battery to isolator	**HC1**	2.2
	Isolator to Motor	**HC2**	1.5
	Battery to Motor	**HC3**	2.4
	Battery: Master to Slave	**HC4**	3.4

6.14. System Component Connections

6.14.1. Jet Unit

Once mounted in the vessel, the jet pod connects to the following:

- Hub via a data cable
- Steering and reverse system mechanical cables
- The battery unit via high current drive cables

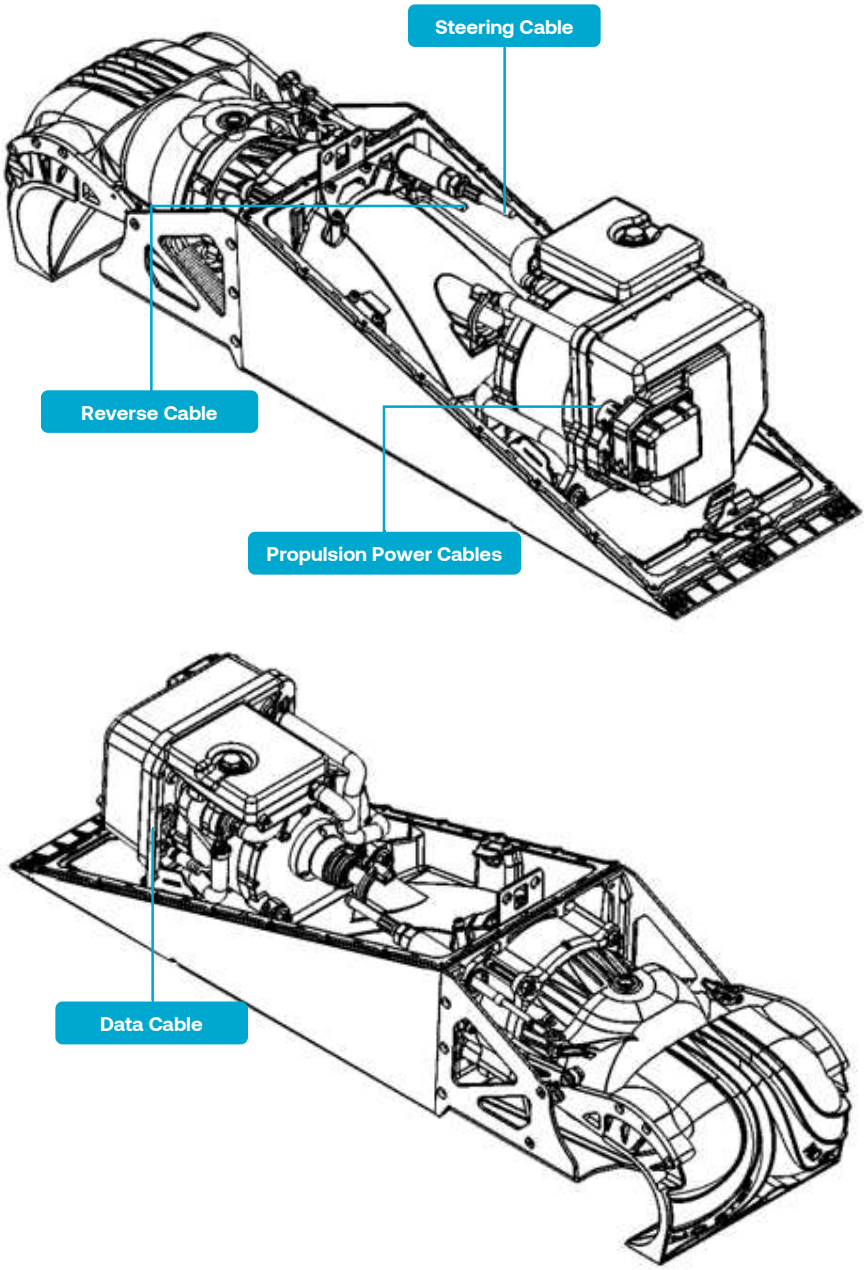


Figure 35: Jet Pod Connections

6.14.2. 10kWh Battery Box

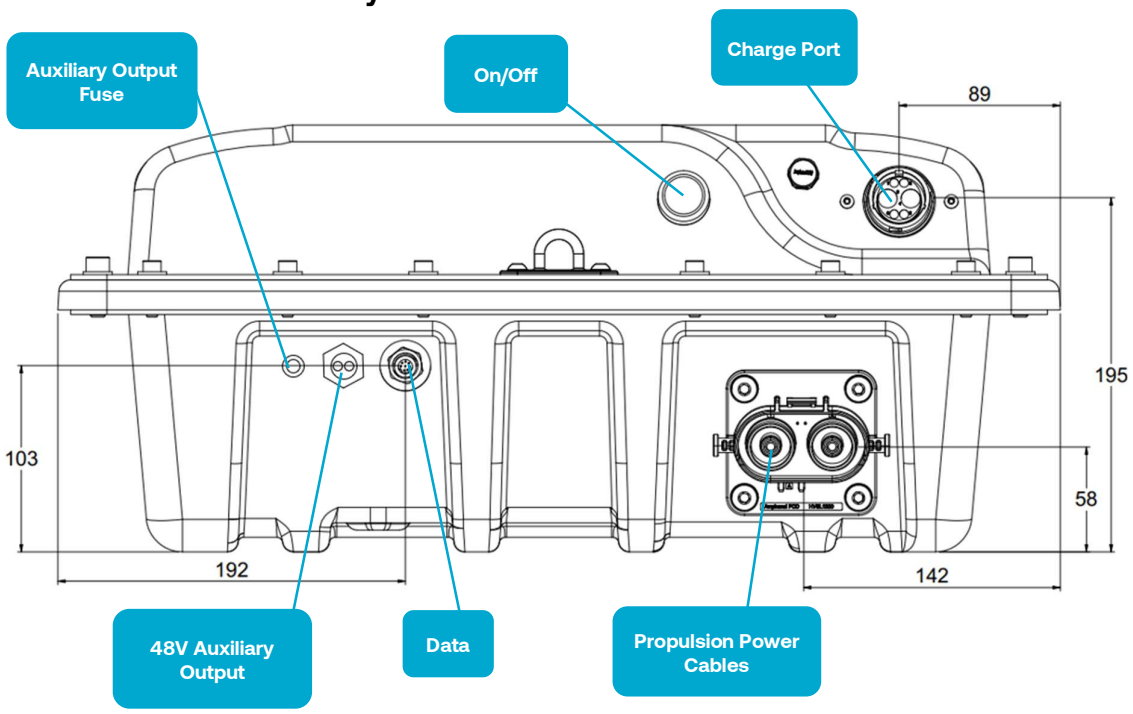


Figure 36: 10kWh Battery Box Connections

Note:

1. The battery on/off switch and the charge port may be supplied with extension assemblies to ensure convenient access. Contact ZeroJet for further details.
2. The ZJ20 battery's 48V auxiliary output may be used to power other systems on the vessel. This may require additional converters to suit the voltage of other systems aboard the vessel. Contact ZeroJet for further details.

6.14.3. 5kWh Battery Boxes

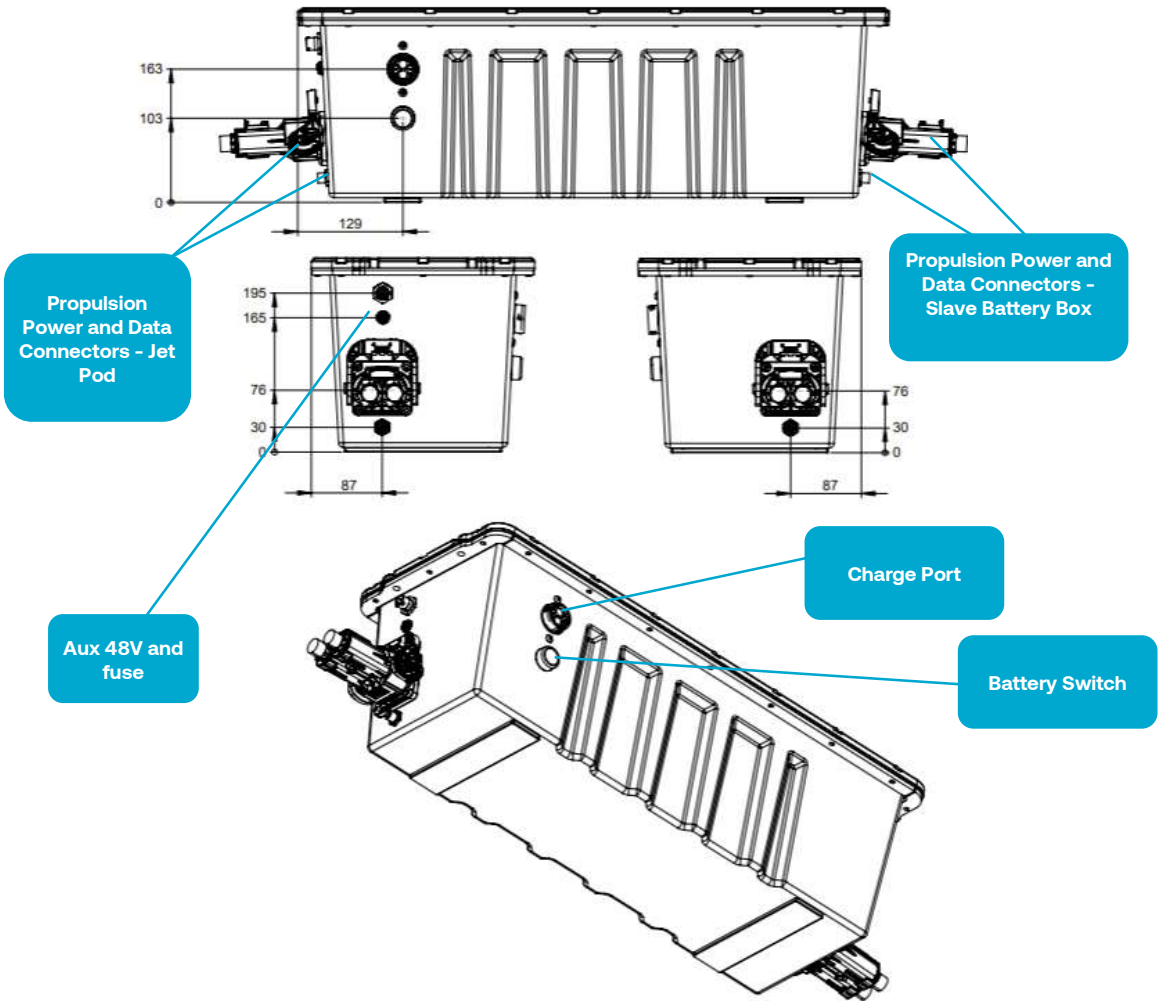


Figure 37: 5kWh Master Battery Box Connections

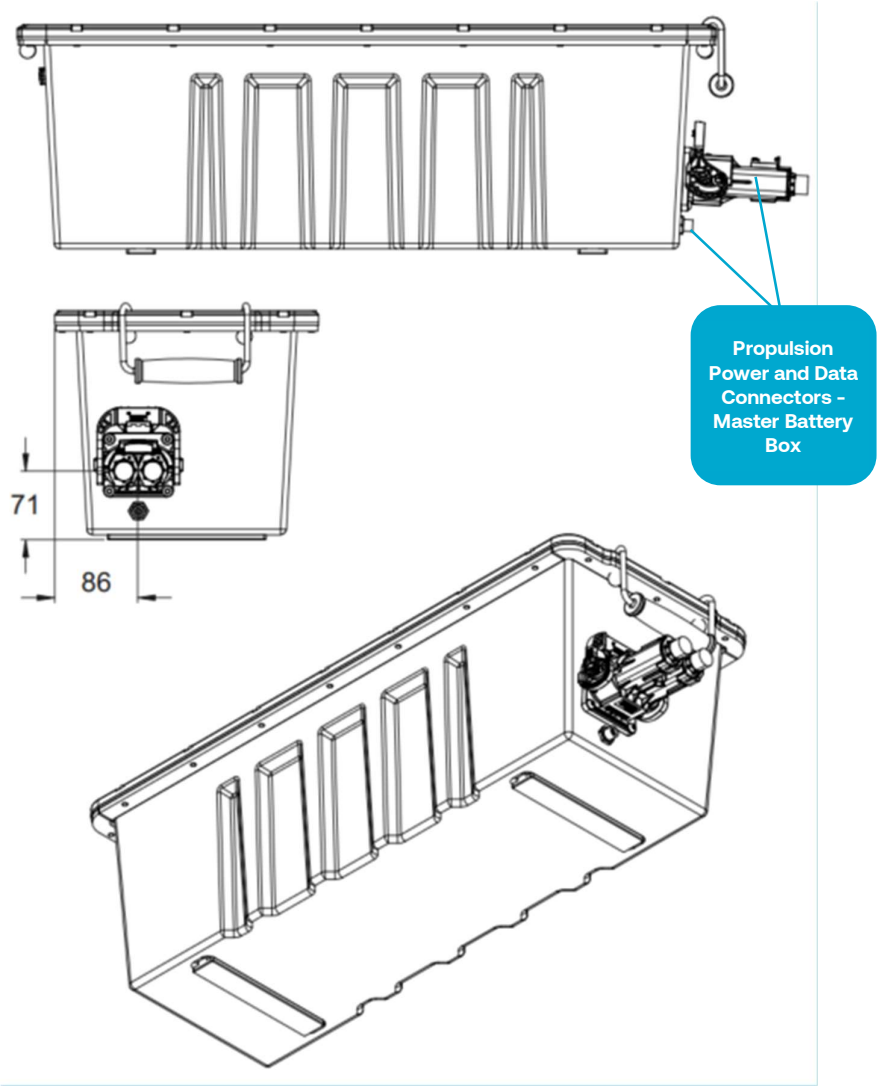


Figure 38: 5kWh Slave Battery Box Connections

6.14.4. Side Mount Throttle

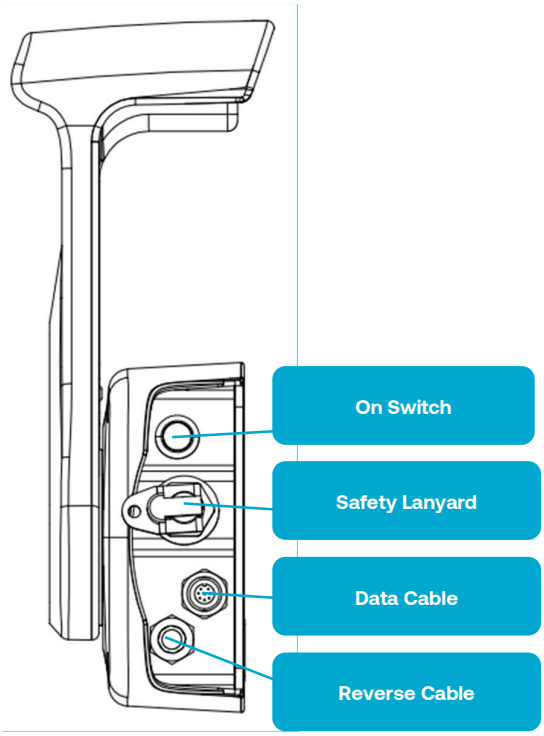


Figure 38: Side Mount Throttle Connections

6.14.5. Tiller

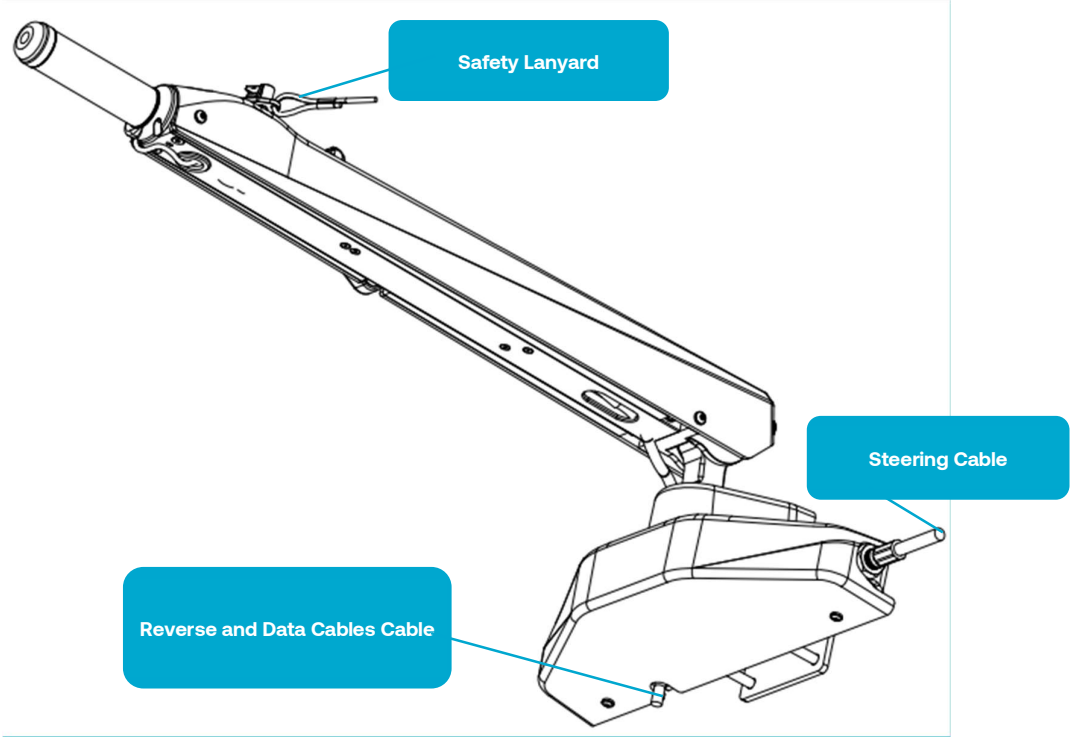


Figure 39: Tiller Connections

6.14.6. Hub

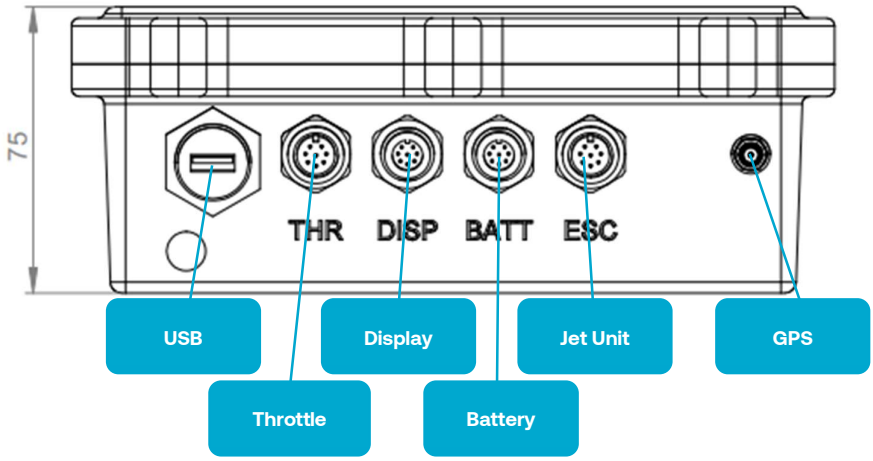
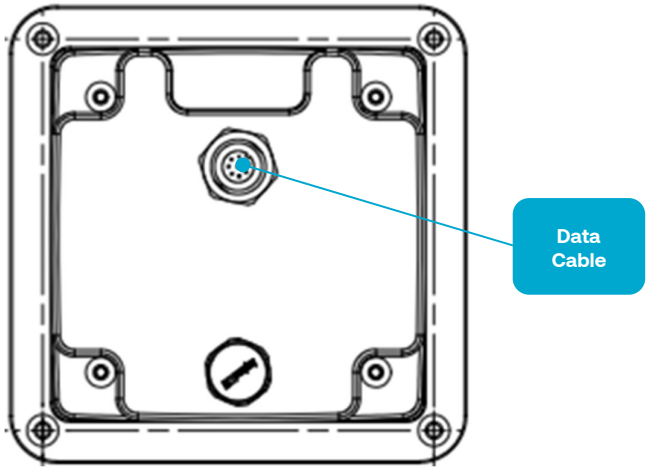


Figure 35: Hub Connections

6.14.7. Display

The display is connected to the hub via a low power data cable (plug and screw



connection).

Figure 40: Display Connections

6.14.8. Isolator Switch

Located in the drive power cable between the battery box and the jet unit, the isolator switch is connected using bolted lugs. The high current cable from the battery may exit the switch on any of the four sides.

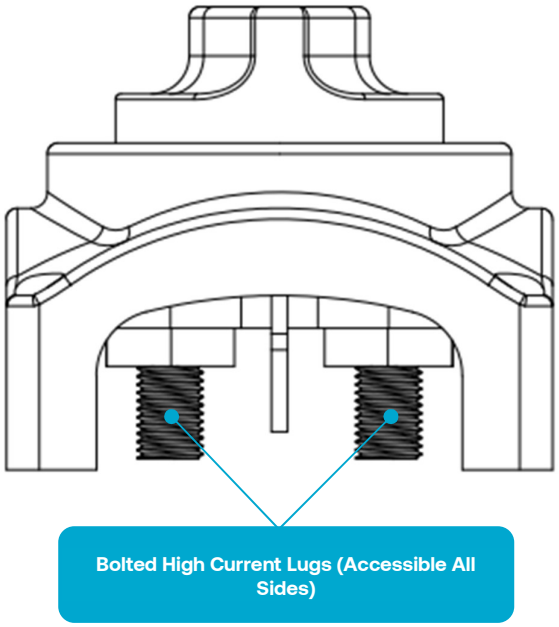


Figure 41: Isolator Switch Connections

7. Access Requirements

Item	Requirement
Jet Unit	- Installation and service access - Access to coolant fill cap on top of motor - Shaft seal service - The motor is moved forward approximately 40mm for access to replace the shaft seal (see below) - Access to the studs around the hull integration flange for fitting
10kWh Battery Pack	- Tool-free access to the on/off button is required (longer term storage). This access may be required when the battery pack is run down to the battery protection cut-out state (the system will provide a number of warnings to aid the user in avoiding this situation) - Access to charging plug (charge extension may be specified where required) - Access to the user replaceable auxiliary power output fuse (flat screwdriver)
5kWh Master Pack	- Access for fitting and removal - Access to charging plug (charge extension may be specified where required) - Access to the jet unit drive power connector is required when the battery pack is run to battery cut out state to reset the BMS (The system will provide a number of warnings to aid the user in avoiding this situation) - Access to the user replaceable auxiliary power output fuse (flat screwdriver)
5kWh Slave Pack	- Access for fitting removal only, including access to high current and data cabling
Helm Unit	- In-use access shaft for steering - Service access to rear for fitting and adjustment
Side Mount Throttle Unit	- In-use access for throttle control - Access to aft for fitting, power button and safety lanyard connection
Tiller Unit	- In-use access for throttle, steering and reverse control as well as power button - Access to aft for mounting plate fitting
Isolation Switch	- Access before and after operation of the vessel to connect and disconnect the battery power - Long-shackle padlock access for users to lock the vessel
Hub	- Installation access is required for all current cables to the hub - Intermittent service access to USB port. This is used for updates to system firmware and extracting system logs for maintenance.

7.1. Jet Unit Dimensions

The following dimensions are provided for designers of new boats seeking to integrate the wedge into their hull and for those working on existing boats that require wedge installation. In both cases, it is essential to read all sections, as each contains pertinent information.

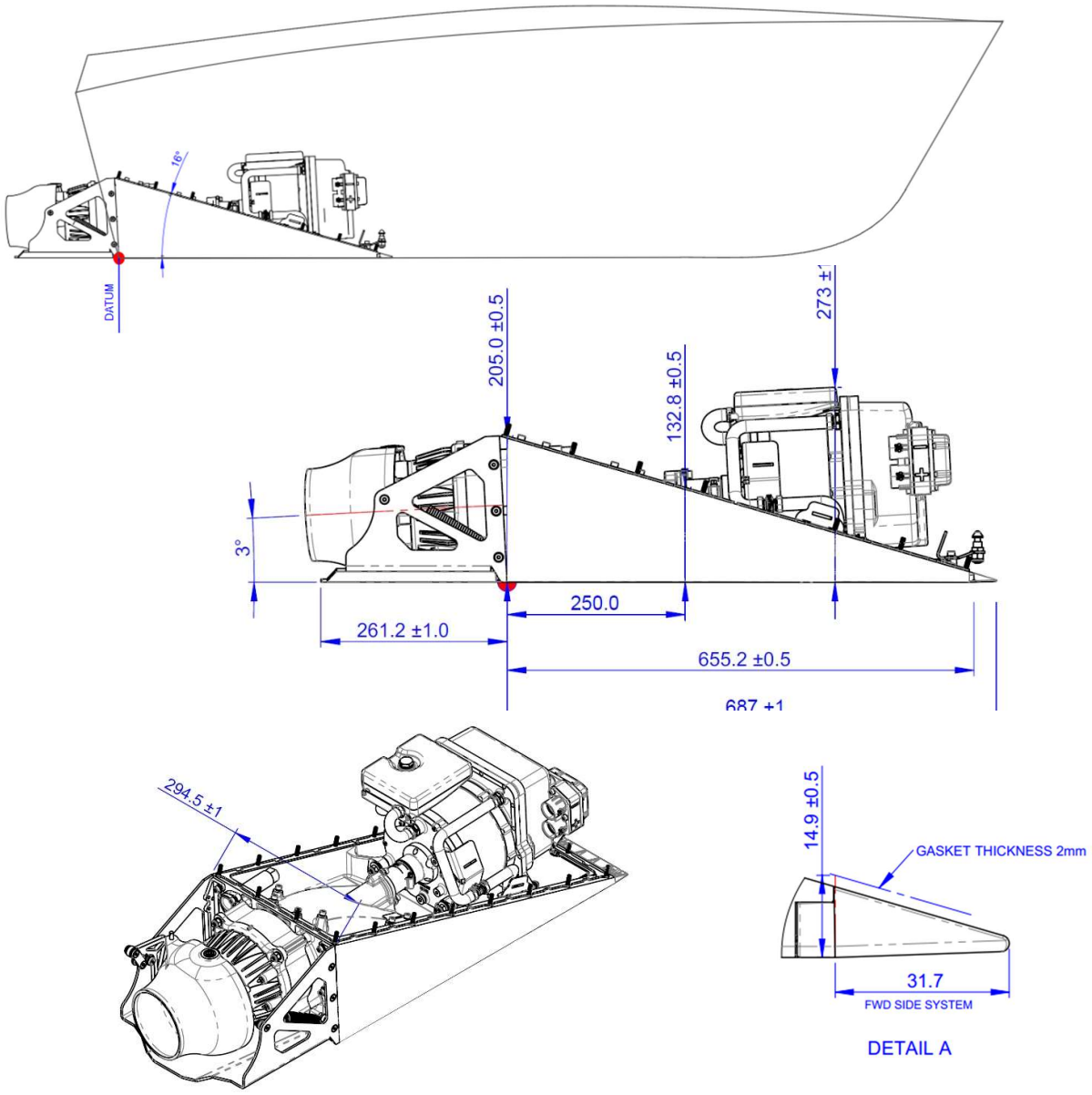


Figure 42: Jet Unit General Dimensions

TIP

Detail A shows the forward edge of the jet unit. This edge is finished with a plastic filler. This filler may be trimmed to suit the vessel geometry.

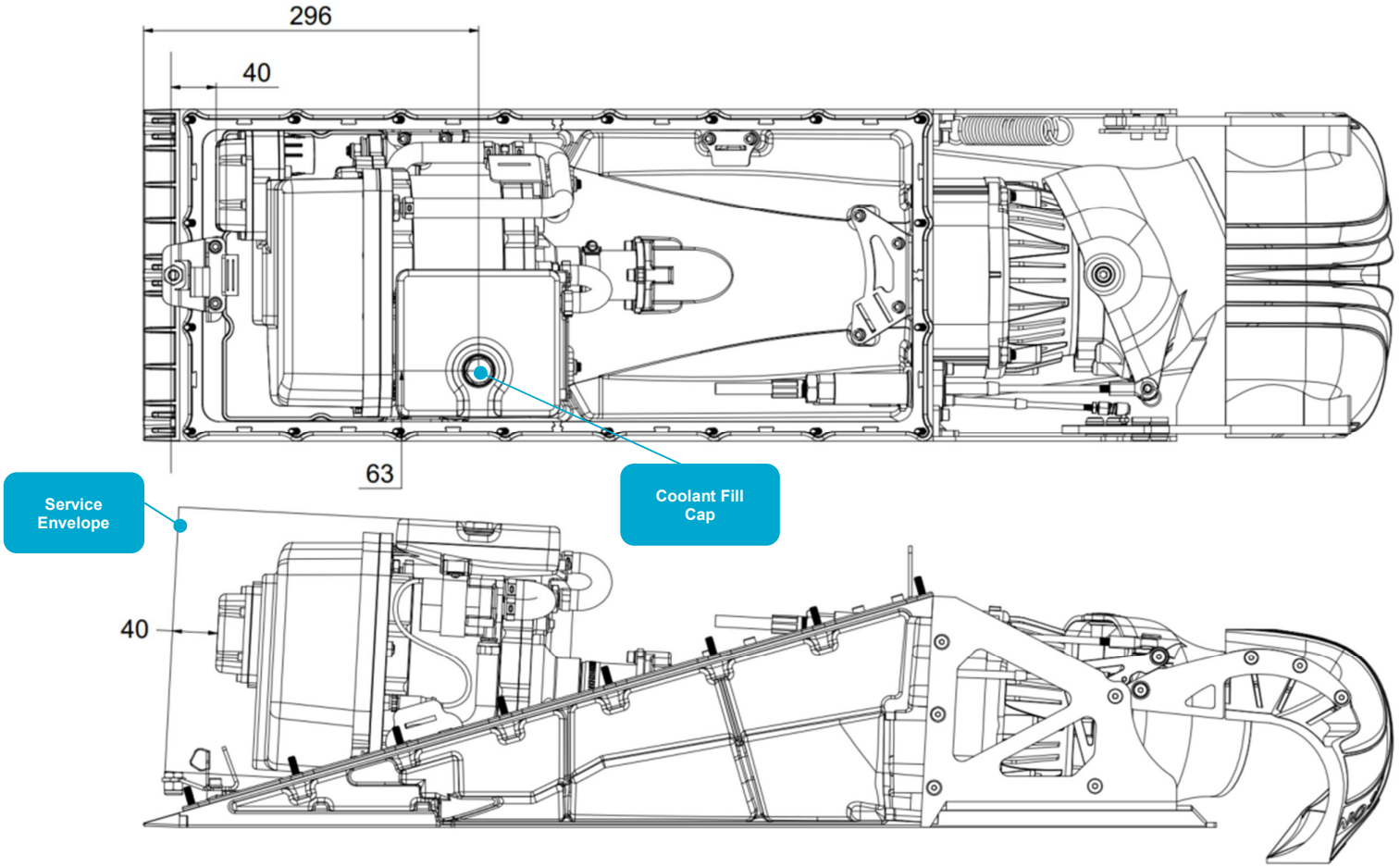


Figure 43: Jet Unit Service Access

Performance - Sample Builds

Item	Boat 1	Boat 2
Boat Type	Rigid	RHIB
Boat Length	3.5m	3.3m
Hull Construction	Carbon Fibre	Aluminium
Hull Weight (Excl. Jet System)	60kg	160kg
System Weight	110kg	150kg
Total Weight	170kg	310kg
Shaft Power	12kW	15kW
Maximum Planing Load	210kg	180kg
Battery Size	5kWh	10kWh
Steering Type	Tiller	Helm
Max Speed	20 knots	19 knots
Runtime @ 3knots	210 mins	

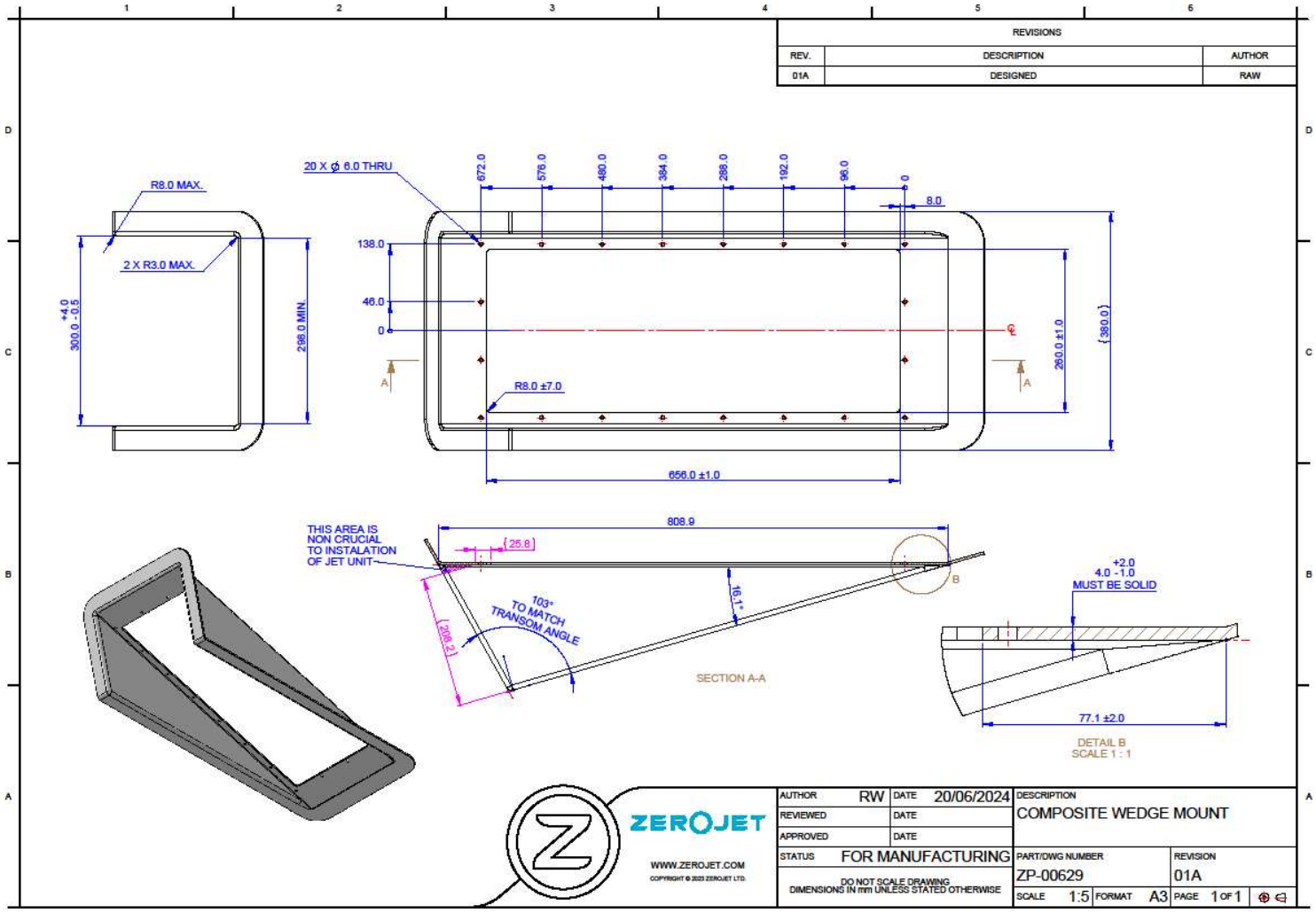


Figure 43: Example Jet Wedge Mount (Illustrative Purposes Only)